A REVISION OF THE PALAEOTROPICAL ARBOREAL ANT GENUS *CATAULACUS* F. SMITH (HYMENOPTERA : FORMICIDAE)

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SYNOPSIS

The ant genus *Cataulacus* F. Smith is fully revised. The species of the Ethiopian and Malagasy regions are treated and keyed out separately from those of the Indo-Australian and Oriental regions; keys to the worker caste are provided for both groups, and for the second group keys to the known females and males are also provided. Fifty-one extant species are recognized as valid and the four known fossil species are reviewed. The seven recognizable species-groups are discussed and the constituent species described. Eight new species are described, four from the Ethiopian region and four from the Indo-Australian region. Sixty names, mostly of infraspecific forms, are newly synonymized. No subgenera are recognized. All known biological information on the various species is included.

INTRODUCTION

The ant genus *Cataulacus*, as constituted at the present time, includes some 51 extant and 4 fossil species, the living forms distributed throughout the Old World tropics with the exception of New Guinea and the Australian land mass. The

living species are not evenly distributed, the majority being found in the Ethiopian region. In the zoogeographical regions occupied by members of the genus the species are distributed as follows:

Ethiopian region: 27 species (26 endemic)
Malagasy region: 8 species (7 endemic)
Oriental region: 6 species (5 endemic)
Indo-Australian region: 12 species (11 endemic).

The main centres of speciation are the Ethiopian region, particularly the rain forest zones, and the Indonesian and Philippine islands in the Indo-Australian region. Madagascar shares a single species with southern Africa and this and some of its remaining species are members of the now dominant species-group of eastern and southern Africa, the *intrudens* (F. Smith) group. The rest of the Madagascan fauna is, however, very specialized and not of the *intrudens*-group. In fact these species are related to *huberi* E. André and its allies, a group predominantly of the West and Central African rain forests. This apparently indicates a double migration of species in the direction Africa→Madagascar, the first consisting of *huberi*-group species and the second and later migration of *intrudens*-group forms.

The Indian subcontinent is very poorly populated at species level, only 3 being known, and with a fourth present on Ceylon and the Andaman Islands. Only a single species, *granulatus* (Latreille), is known to occur in both the Oriental and Indo-Australian regions. The most easterly record of the genus is from Waigeo Is., off north-west New Guinea (Irian Barat), and a marked decrease in the number of species occurs along the Indonesian islands in a west-east direction, as discussed in the introduction to the species of the region.

The fossil species are known mostly from areas now well outside the range of the genus, namely southern and eastern Europe, and indicate a much wider distribution for the genus during Tertiary times.

At no point in its range can any species of *Cataulacus* be considered dominant over other arboreal ant genera, nor are they known to be abundant in absolute numbers over wide areas, but certain species are noticeably much more common within their range than others and where such species occur they may constitute a good proportion of the arboreal ant fauna and are usually quite conspicuous. In this last category may be placed *guineensis* F. Smith of the West and Central African forests, *intrudens* of southern and eastern Africa and *granulatus* of the Oriental and Indo-Australian regions.

All known species are arboreal or subarboreal nesters and they predominantly forage on the trees and shrubs in which the nests are situated. Very few appear to come down to ground level but in West Africa the small species *pygmaeus* E. André and *brevisetosus* Forel may be found foraging in leaf litter or crossing the ground to ascend a tree other than the one in which the nest is situated. The nests themselves are usually constructed in small hollow twigs or stems by the smaller species and in rotten branches or rotted portions of the tree trunk by the larger species. This is rather a generalization as some small species are known which nest in and under rotten bark (e.g. *vorticus* sp. n.) and undoubtedly some

of the larger forms will eventually be found inhabiting relatively small cavities in plants. Various species of the genus in Africa are known to inhabit a variety of galls, acacias and bushes as well as large trees. Other than forest trees the plants known to harbour *Cataulacus*, many of them myrmecophiles, and the species which inhabit them are summarized below; the authority for each discovery is noted in parentheses.

intrudens (F. Smith): in acacia thorns (F. Smith, 1876 : 609; Arnold, 1917 : 391)
: in galls (Forel, 1894 : 78)
: in *Combretum apiculatum* Sond (Prins, 1965 : 104)
weissi Santschi: in galls (Bequaert, 1922 : 370)
: in *Randia myrmecophila* De Wildeman (Forel, 1916 : 427)
: in *Plectronia* sp. (Wheeler, 1922*a* : 199)
bequaerti Forel: in galls (Bequaert, 1922 : 370)
brevisetosus Forel: in acacia (Arnold, 1917 : 398)
: in *Theobroma cacao* L. (present author, see below)
pilosus Santschi: in *Cuviera angolensis* Hiern (Bequaert, 1922 : 490)

Of the species found on cocoa in West Africa probably the most common is *guineensis*. In a survey conducted in Nigeria, Booker (1968) noted three species on cocoa whilst Room (1971) listed five species from a Ghanian cocoa farm. These were *pygmaeus*, *guineensis*, *mocquerysi* (sp. K, in Room), *egenus* (sp. G, in Room) and probably *vorticus* (sp. H, in Room). A survey by the present author in Nigeria and Ghana revealed these same five species along with *brevisetosus*, noted above. Specimens received in 1968 from M. B. de Miré of the Institut français du Café, du Cacao, Cameroun suggest that *kohli* nests in cocoa trees in that country; and *theobromicolus* from Zaire probably also nests in cocoa.

Feeding habits in the genus are mostly unknown but Arnold (1917 : 388) has recorded an unidentified species breaking into termite tunnels and attacking the inmates, and the present author has noted *guineensis* tending aphids and small coccids.

On the plants ants of the genus *Cataulacus* often occur together with *Oecophylla* F. Smith or species of *Crematogaster* Lund, and appear to be mostly tolerated (at least they are not evicted) by the majority of these forms. Their defence against attackers of these genera lies primarily in their armoured exterior, but their ultimate escape reaction is to curl up and release their grip on the plant, falling to the ground and thus making their escape. The decision to remain immobile and present an armoured surface or to drop from the plant appears to depend upon the size or persistence of the aggressor; larger attackers usually precipitate the latter reaction, but it has also been noted as a result of persistent and unwanted attention by a series of workers of a small *Crematogaster* species.

Although considerably over a century old the genus, as such, has not been revised previously. Indeed the majority of earlier authors passed it over without comment or criticism and no check whatever was placed upon the amazing and completely uncalled for proliferation of specific and infraspecific names, especially amongst the African forms. The haphazard and often irrelevant descriptions by F. Smith

during the third quarter of the last century led to the redescription as new of many of his species by later authors who, quite understandably, could not correlate Smith's descriptions with the specimens available to them. This tradition was continued by numerous authors who relied upon trivial differences in sculpturation, shape and size to delimit their species or infraspecific forms and the accurate and detailed descriptions of Mayr and Emery stand in complete contrast to the majority of descriptions produced in the first two decades of this century, most of which are almost valueless.

Arnold (1917) was the first to draw attention to the sorry state of affairs in the genus when he monographed the species of South Africa. He pointed out that he had not attempted to key the species as, 'many of the so-called species and races are very closely allied', and he considered that a study based on more material would reduce the number of species to a much lower figure. Despite this he did attempt a key to the South African species in the next part of his monograph (Arnold, 1920 : 403), prefacing it with the remarks, 'I have endeavoured to draw up a key to the six forms which I have seen, but in view of the trifling distinctions on which authors have seen fit to erect new species in this genus, too much reliance should not be placed on it.' The Oriental regional fauna escaped to a great extent the proliferation of names characteristic of the African fauna and this is probably attributable to the quite early publication of a key by Forel (1902) and more notably of a key and descriptions by Bingham (1903), the latter of which did much to fix the identity of the more common species and indeed some of the rarer ones. The Indo-Australian, Malagasy and Ethiopian regional faunas apart from those of South Africa have not previously been keyed.

The present study has reduced the number of names in the genus to about half, mostly by the synonymy of infraspecific forms. Eight new species have been described, the majority from material loaned by various museums and institutions, but it seems apparent that numerous new species await discovery and it is to be hoped that this paper stimulates some interest in the biology and ecology of this remarkable group of ants, which are mostly unknown at the present time.

ABBREVIATIONS OF MUSEUMS AND INSTITUTIONS

AMNH, New York	American Museum of Natural History, New York, U.S.A.
BMNH	British Museum (Natural History), London, England.
IE, Bologna	Istituto di Entomologia dell'Università, Bologna, Italy.
MCSN, Genoa	Museo Civico di Storia Naturale, Genoa, Italy.
MCZ, Boston	Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MHN, Geneva	Muséum d'Histoire Naturelle, Geneva, Switzerland.
MNHN, Paris	Muséum National d'Histoire Naturelle, Paris, France.
MNHU, Berlin	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (D.D.R.).
MRAC, Tervuren	Musée Royal de l'Afrique Centrale, Tervuren, Belgium.
NM, Basle	Naturhistorisches Museum, Basle, Switzerland.
NM, Vienna	Naturhistorisches Museum, Vienna, Austria.
NMR, Bulawayo	National Museum of Rhodesia, Bulawayo, Rhodesia.
UG, Accra	University of Ghana, Legon, Accra, Ghana.
UM, Oxford	University Museum, Oxford, England.
USNM, Washington	United States National Museum, Washington D.C., U.S.A.

MEASUREMENTS AND INDICES

The following dimensions and ratios have been found to be useful in separating species in the genus; all measurements are expressed in millimetres.

Total Length (TL). The total outstretched length of the individual, from the mandibular apex to the gastral apex.

Head Length (HL). The length of the head proper, measured in a straight line from the anterior clypeal margin to the mid-point of the occipital margin, in full-face view.

Head Width (HW). The maximum width of the head behind the eyes, measured in full-face view.

Cephalic Index (CI). $\frac{HW \times 100}{HL}$

Eye Length (EL). The maximum length of the eye, measured in dorsal full-face view.

Ocular Index (OI). $\frac{EL \times 100}{HW}$

Inter-Ocular Distance (IOD). The distance between the inner margins of the eyes at their midlength in full-face view.

Scape Length (SL). The straight-line length of the elongate first antennal segment excluding the basal constriction or neck. Usually measured in side-view with the scape in its scrobe as it is usually in this position in mounted specimens.

Scape Index (SI). $\frac{SL \times 100}{HW}$

Pronotal Width (PW). The maximum width of the pronotum in dorsal view.

Alitrunk Length (AL). More exactly Weber's AL; the diagonal length of the alitrunk in lateral view from the point at which the pronotum meets the cervical shield to the apex of the metapleural lobes or teeth.

Metathoracic Tibial Length (MTL). The maximum length of the tibia of the metathoracic (hind) pair of legs.

DEFINITION OF, AND NOTES ON, THE GENUS

CATAULACUS F. Smith

Cataulacus F. Smith, 1853 : 225. Type-species: *Cataulacus taprobanae* F. Smith, loc. cit., by subsequent designation of Bingham, 1903 : 120.

Otomyrmex Forel, 1891*a* : 147 [subgenus of *Cataulacus*]. Type-species: *Cataulacus oberthueri* Emery, *in* Forel, op. cit.: 146, by monotypy. **Syn. n.** (See note 3, below.)

Diagnosis. Monomorphic, arboreal myrmicine ants with the head and usually also the body somewhat depressed. Antennae 11-segmented with a 3-segmented club. Palp formula

5,3. Anterior clypeal margin usually notched or impressed medially. Frontal carinae very widely separated, strongly expanded. Antennal scrobes present, running below the large eyes, bounded by the frontal carinae only anterodorsally. First gastral tergite very much enlarged, constituting the entire dorsal gaster in female and worker and the greater portion of the dorsum in the male. Wings always with *r–m* and *m–cu* absent, and with *M* fused to *Rs* until close to *2r*. Male genitalia partially retractile, with cuspis of volsella absent, digitus strongly developed into a broadly T-shaped structure; aedeagus serrate or denticulate ventrally.

DEFINITION. *Worker*. Minute to large (TL 2·7 – 11·0), mostly black myrmicine ants; monomorphic although often with a considerable size-range within the species, and with the head and body somewhat dorsoventrally flattened.

Mandibles with 1 to 3 apically situated teeth followed by a row of small to minute denticles or by an unarmed apical (masticatory) margin. Palp formula maxillary 5, labial 3-segmented. Clypeus large, rounded behind, usually notched or with an arcuate impression anteromedially and with the anterolateral corners acute or dentate. Clypeal suture often reduced or faint but rarely completely absent. Frontal carinae widely separated, strongly expanded laterally, reaching almost or quite to the level of the eye where they are almost invariably produced into a preocular tooth. The frontal carinae usually overhang the sides of the head of front of the eye and form the apparent lateral margins of the head in front of the eye in full-face view. Antennal scrobes present, running below the eyes and capable of accommodating the whole antenna. Anteriorly the scrobes are bounded above by the frontal carinae but below and behind the eyes the scrobal margins are constituted of the side wall of the head capsule. Scrobes often bounded below by a carina which terminates in a ventrally-directed tooth posteriorly. Antennae 11-segmented, the three apical funicular segments forming a club. Scape curved and much thicker apically than basally. The eyes are distinct, usually large or very large; ocelli are absent (except in some individuals of *latus*). Alitrunk usually marginate laterally at least on the pronotum (faint in *oberthueri*, absent from *insularis*), the margination often equipped with denticles, spines, teeth or lobiform prominences. Dorsal alitrunk often without sutures but the promesonotal suture may be marked by a faint line or impression. Sutures visible laterally upon the alitrunk; a transverse suture on the mesepisternum nearly always evident. Mesokatepisternum with the anteroventral corner produced into a spine, tooth or tubercle, rarely only an acute angle. Propodeum usually bispinose, more rarely bidentate, unarmed in one species (*inermis*); metapleural lobes or teeth present at the base of the propodeal declivity. Legs with the femora usually grooved or bicarinate beneath to receive the tibiae. Petiole sessile, with a distinct ventral process; in some species the postpetiole also with such a process. First gastral tergite greatly expanded, comprising the whole of the dorsum of the gaster in dorsal view. First sternite also much enlarged, the remaining segments very reduced, visible apically and apicoventrally. Sting reduced or vestigial, apparently non-functional. Hairs in the species are typically short, broad and blunt but variously specialized in some species, absent in others; almost invariably with 3 to 4 long bristles projecting from the lower border of the eye. Full adult coloration uniform black or black-brown, commonly with the antennae, tibiae and tarsi lighter, yellow or yellow-brown.

Female. Similar to the worker but the head always with ocelli developed, the alitrunk with flight sclerites and with well-marked dorsal sutures. Venation as shown in Text-figs 1–4, discussed below (note 4). Gaster usually more elongate than in the worker and often with virtually parallel lateral borders.

Male. Head constructed basically as in worker but with ocelli present. The frontal carinae are not so strongly expanded laterally and in some species the sides of the head proper are visible below the carinae when in dorsal view. Preocular teeth often absent. The head capsule itself is strongly narrowed in front of the large, very prominent eyes. Pronotum well developed, clearly visible in dorsal view and not at all overhung by the mesoscutum. Parapsidal furrows present. Notauli usually with the anterior arms of the Y-shape developed and cross-ribbed; the posterior arm often little or not developed, rarely as well developed as the anterior arms. Venation as in the female. Propodeum bidentate or bispinose; the petiole and sometimes

also the postpetiole more elongate and slender than in the female or worker castes but the ventral processes similarly developed. First gastral tergite very large but not as strongly developed as in the other castes; the following segments usually visible in dorsal view. Genitalia partially retractile, but the highly sclerotized apical portions of the parameres always projecting. In species examined the genitalia had the aedeagus at least strongly serrate ventrally, usually denticulate; volsellae with cuspis absent and the digitus developed into a much enlarged, broadly T-shaped lamelliform structure. The basal portion of each paramere is much less strongly sclerotized than the apical, projecting portion, the latter usually with numerous fine hairs.

Larva. G. C. Wheeler & J. Wheeler (1960) defined the larvae as follows: body profile elongate-subelliptical, with the head applied to the ventral surface near the anterior end. Under this grouping the *Cataulacus* larvae were given as cataulaciform; with the body profile straight, elongate-subelliptical; prothorax forming a very short, stout neck which is inclined ventrally to 45 degrees; segmentation indistinct. The mandibles were also described as cataulaciform: roughly trapezium-shaped, the apex forming a slender, short acute tooth which is curved medially; subapical portion of medial border more or less projecting and bearing 2 to 5 minute teeth.

Pupa. Free, not enclosed in cocoons.

Notes on the genus.

1. At present the genus *Cataulacus* stands as the sole member of the tribe Cataulacini, but after the erection of the genus it was treated by Smith (1876) as a member of the family Cryptoceridae, in which he also included *Meranoplus* F. Smith, and the constituents of the present tribe Cephalotini. Emery (1893*b*) suggested the dissolution of this patently artificial and very mixed group, and went so far as to note that *Cataulacus* formed a distinct group on its own. During his attempt to overhaul the higher classification of the Formicidae, Forel (1917*a*) created a section Rhagiomyrmicinae to include myrmicine ants characterized by 'the flattening of the head and often the entire body, and also by the numerous lateral appendages of the latter'. These criteria resulted in the aggregation of five tribes (by modern standards) under one section which, incidentally, came very close to F. Smith's concept of a family Cryptoceridae. The included tribes were the Basicerotini, Cataulacini, Cephalotini (=Cryptocerini), Dacetini and Stegomyrmecini, and they are only linked by the trivial and inconsistent characters given by Forel, which are certainly the results of convergence rather than an expression of actual relationship. Emery (1921) rightly criticized this grouping as unnatural and referred Rhagiomyrmicinae to the synonymy of the various tribes involved.

The genus *Cataulacus* now stands in isolation, its derivation and affinities not understood, but it is certainly not closely related to any of the tribes with which it was traditionally grouped.

2. Detailed larval descriptions are given by G. C. Wheeler & J. Wheeler (1954 : 149–151) for the species *egenus*, *horridus* (now a synonym of *insularis*) and *taprobanae*. The material studied for this last species was stated as '20 larvae from the Philippine Islands'. As this is the case then the species in question is not *taprobanae*, which is

restricted to India and Ceylon, but most probably either *catuvolcus* or *chapmani*, species related to *taprobanae*, from the Philippines.

3. The subgenus *Otomyrmex* was erected by Forel (1891*a*) to include the rather aberrant Madagascan species *oberthueri*. The characters which he used to separate the subgenus rested chiefly upon the prolongation of the occipital spines, but he also mentions that the pedicel segments are elongate, much longer than broad, and that the legs lacked asperities. Wheeler (1922*b* : 665) stated that he could not recognize the subgenus as the character of elongate occipital corners was found among many species of *Cataulacus*. This is correct, and the corners are particularly strongly and more impressively developed in *insularis*. Of Forel's other characters, elongate pedicel segments, where the length exceeds the width are not uncommon and neither are relatively smooth legs, especially in the *huberi* species-group. The present survey has shown *oberthueri* to be a member of this last group but very specialized structurally by the reduction of various characters. In consequence *Otomyrmex* has been placed in the synonymy of *Cataulacus*.

4. Venation in the Formicidae has been investigated by Brown & Nutting (1950), who show that the form of venation encountered in *Cataulacus* has been developed in numerous other groups and appears to be reasonably stable. The major features of the venation are shown in Text-figs 1–2, and the principal reductions in Text-figs 3–4. The main characters of the venation are that cross-vein *m–cu* is absent and that *r–m* has been lost either by fusion to *Rs* + *M* which is often much thickened before the splitting off of *M* (Text-fig. 1) or by contraction (Text-fig. 2). The compound vein *Rs* + *M* may split into its component parts either proximal to, at, or distal to the junction with cross-vein *2r*, with the last of these appearing to be predominant. The first possibility is seen in *latus*, the second in *catuvolcus* and some females of *granulatus*, and the third in *egenus*, but the situation is quite variable even in different individuals from the same series. In *catuvolcus* (Text-fig. 4) and some *granulatus* the descending portion of *Rs* is broken. The reduction in length of *M* is common in the genus as is the reduction of *CuA* and the distal portion of *Rs*. The cross-vein *cu–a* is often incomplete, but in a male of *egenus* and a female of *huberi* examined it was double.

5. The occipital crest is a character of use in separating some species of the genus and is defined as follows: a transverse ridge, or carina or row of denticles, or a combination of both, running across the posterior border of the head and effectively separating the vertex from the occiput. The various development of the crest may be seen in Text-figs 37, 41, 39, where it is simple in *catuvolcus*, denticulate in *nenassus* and absent from *hispidulus*.

THE SPECIES OF THE ETHIOPIAN AND MALAGASY REGIONS

Thirty-four species are known from the Ethiopian and Malagasy regions, of which 7 are peculiar to Madagascar and its island systems. A single species is found on Madagascar which is also known from southern Africa but otherwise the Malagasy fauna is quite distinctive.

The study of the species of these regions is by necessity based upon the worker caste as the sexual forms remain unknown in a majority of cases.

The species fall into four groups which are listed below, along with their synonyms. Characterizations of the groups are given under the appropriate sections. Previous notes on the biology of the Ethiopian regional fauna are to be found in Arnold (1917) and Wheeler (1922*a*), and the species known at that time were catalogued by Wheeler (1922*c*). References to nest sites, etc., are scattered through the literature of original descriptions; these have been noted in the systematic treatment by species.

Unsurprisingly the majority of species are forest-dwelling forms, with relatively few adapted to savannah or veldt conditions. Those which do, however, occur in these zones tend to be very successful in their chosen habitat and often possess a wide distribution. A few species are apparently able to exist in any region of Africa providing the basic essentials of nesting-site and food supply are met with, but on the whole the fauna may be divided into forest and non-forest forms.

***huberi*-group**
- ***egenus*** Santschi
  - *egenus* st. *simplex* Santschi **syn. n.**
- ***huberi*** E. André
  - *huberi* var. *longispinus* Stitz **syn. n.**
  - *huberi* race *herteri* Forel **syn. n.**
  - *huberi* subsp. *guilelmi* Wheeler **syn. n.**
  - *huberi* st. *herteri* var. *luebensis* Santschi (unavailable name)
- ***inermis*** Santschi
- ***kohli*** Mayr
  - *kohli* st. *brazzavillensis* Santschi **syn. n.**
  - *foveolatus* Stitz **syn. n.**
  - *latipes* Menozzi **syn. n.**
- ***lobatus*** Mayr
- ***oberthueri*** Emery
- ***porcatus*** Emery
- ***pullus*** Santschi
  - *coriaceus* Stitz **syn. n.**
  - *pullus* var. *orientalis* Santschi **syn. n.**
- ***regularis*** Forel
- ***tardus*** Santschi
  - *schoutedeni* Santschi **syn. n.**
- ***theobromicolus*** Santschi
- ***wasmanni*** Forel

***tenuis*-group**
- ***adpressus*** **sp. n.**
- ***brevisetosus*** Forel
  - *lujae* Forel **syn. n.**
  - *lujae* var. *gilviventris* Forel **syn. n.**
  - *jeanneli* Santschi **syn. n.**
  - *pygmaeus* st. *degener* Santschi **syn. n.**
  - *pygmaeus* st. *lujae* var. *plebeja* Santschi (unavailable name)
  - *janneli* (sic) var. *loveridgei* Santschi **syn. n.**
  - *meduseus* Santschi **syn. n.**

difficilis Santschi
elongatus Santschi
impressus **sp. n.**
pilosus Santschi
striativentris Santschi
donisthorpei Santschi **syn. n.**
tenuis Emery
vorticus **sp. n.**
weissi Santschi
traegaordhi var. *plectroniae* Wheeler **syn. n.**
jeanneli st. *kenyensis* Santschi **syn. n.**

intrudens-group
bequaerti Forel
ebrardi Forel
fricatidorsus Santschi
intrudens (F. Smith)
intrudens var. *rugosus* Forel **syn. n.**
hararicus Forel **syn. n.**
johannae Forel **syn. n.**
baumi Forel **syn. n.**
baumi race *batonga* Forel **syn. n.**
baumi race *batonga* var. *bulawayensis* Forel (unavailable name)
rugosus var. *subrugosus* Santschi **syn. n.**
intrudens st. *intermedius* Santschi **syn. n.**
johannae race *densipunctatus* Stitz **syn. n.**
baumi st. *pseudotrema* Santschi **syn. n.**
baumi var. *gazanus* Santschi **syn. n.**
baumi st. *pseudotrema* var. *tangana* Santschi (unavailable name)
foveosquamosus Santschi **syn. n.**
umbilicatus Santschi **syn. n.**
rugosus var. *krugeri* Prins (unavailable name)
micans Mayr
intrudens st. *tristiculus* Santschi **syn. n.**
mocquerysi E. André
mocquerysi var. *nainei* Forel **syn. n.**
pygmaeus E. André
pygmaeus var. *chariensis* Santschi **syn. n.**
pygmaeus var. *bakusuensis* Forel **syn. n.**
traegaordhi Santschi **syn. n.**
trägårdhi [sic] var. *ugandensis* Santschi **syn. n.**
marleyi Forel (provisional synonym)
jeanneli var. *aethiops* Santschi **syn. n.**
pygmaeus subsp. *suddensis* Weber **syn. n.**
voeltzkowi Forel
wissmanni Forel
wissmanni race *otii* Forel **syn. n.**
wissmanni st. *linearis* Santschi **syn. n.**
micans race *durbanensis* Forel **syn. n.**

guineensis-group
erinaceus Stitz
princeps 'Emery' (nomen nudum)
erinaceus var. *crassispina* Santschi **syn. n.**
greggi **sp. n.**

guineensis F. Smith
parallelus F. Smith **syn. n.**
guineensis race *sulcinodis* Emery **syn. n.**
sulcatus Stitz
sulcatus var. *alenensis* Stitz **syn. n.**
sulcatus var. *fernandensis* Stitz **syn. n.**

Key to the species of the Ethiopian and Malagasy Regions

(Based on worker caste)

Note: because of sculptural variation *intrudens* is keyed out in two places.

1 Propodeum completely unarmed, without spines or teeth; propodeal dorsum transversely rugulose. (Zaire) . . . . . ***inermis*** (p. 21)
– Propodeum armed, usually with a pair of distinct spines, more rarely with a pair of short teeth; if the latter then the propodeal dorsum is not transversely rugulose . 2
2 First gastral tergite with a lateral margination or carina at least basally which is paralleled by a similar structure on the first sternite. Node of petiole transversely rectangular in dorsal view, strongly transversely rugose or sulcate . . . 3
– First gastral tergite rarely with, usually without a lateral margination or carina basally, this structure never developed upon the sternite. Node of petiole usually not transversely rectangular in dorsal view, rarely transversely sculptured . 4
3 Sides of head behind eyes irregular, either denticulate, crenulate or otherwise jagged. Relatively broader-headed species, CI > 125, the head strongly broadened behind the eyes. Laterally projecting hairs on the sides of the head behind the eyes long and conspicuous. (West and Central Africa, Uganda, Zambia) . ***huberi*** (p. 19)
Sides of head behind eyes regular, smooth, neither denticulate nor crenulate. Relatively narrower-headed species, CI 120 or less, the head not strongly broadened behind the eyes. Laterally projecting hairs on the sides of the head behind the eyes minute and inconspicuous or completely absent. (West and Central Africa) . . . . . ***egenus*** (p. 18)
4 Petiole and postpetiole strongly transverse, much flattened dorsoventrally, without nodes; both very broadly and thickly V-shaped in dorsal view. Propodeal spines very small, inconspicuous, reduced to a pair of short or minute triangular teeth. (West Africa, Zaire) . . . . . ***mocquerysi*** (p. 47)
– Petiole and postpetiole nodiform, not strongly transverse nor flattened, not broadly V-shaped in dorsal view. Propodeal spines well developed, conspicuous, not reduced to triangular teeth 5
5 Occipital corners of head drawn out into a long, very broadly triangular point on each side. Sides of head behind eyes and lateral margins of alitrunk without denticles, the alitrunk laterally also without projecting lobes, teeth or prominences. Preocular tooth absent. Very large species, HW > 2·60 with relatively very small eyes, OI < 22. (Madagascar) . . . . . ***oberthueri*** (p. 24)
– Occipital corners of head with a tooth, a denticle or unarmed, but not drawn out into a long, broadly triangular point. Sides of head behind eyes or margins of alitrunk usually denticulate, or the alitrunk laterally with projecting lobes, teeth or prominences. Preocular tooth usually present. Smaller species, HW < 2·60 with relatively larger eyes, OI > 22 6
6 In profile the dorsal surfaces of the head behind the clypeus and the dorsal alitrunk without projecting erect hairs (a few may be present on the margins and around the eyes) or with sparse, strongly adpressed hairs 7

– In profile either the dorsal surfaces of the head behind the clypeus or the dorsal alitrunk or both with projecting, erect hairs, often numerous but sometimes sparse or short and inconspicuous; never strongly adpressed 14

7 Mesonotum regularly longitudinally striate, the propodeal dorsum regularly transversely striate. (Madagascar: Ste. Marie Is.) . . ***wasmanni*** (p. 29)

– Sculpturation of mesonotum and propodeal dorsum either not striate or regularly longitudinally sculptured throughout, the direction of sculpturation not differing on mesonotum and propodeal dorsum 8

8 Dorsum of alitrunk sculptured with regular, parallel, longitudinal sulci throughout . 9

– Dorsum of alitrunk finely and densely reticulate-punctate with fine, longitudinal rugulae or a rugoreticulum 10

9 Dorsum of head evenly longitudinally sulcate, as the alitrunk. Dorsum of alitrunk without short, strongly adpressed hairs. Larger species, HL > 1·10, PW > 0·90, with relatively broader head and smaller eyes, CI 100 or more, OI < 40. (Madagascar) . . . . . ***regularis*** (p. 27)

– Dorsum of head finely reticulate-punctate with an overlying rugoreticulum, contrasting to the sulcate alitrunk. Dorsum of alitrunk with a few scattered, small, strongly curved, adpressed hairs, best seen upon the propodeal dorsum. Smaller species, HL < 0·95, PW < 0·75 with relatively narrower head and larger eyes, CI < 95, OI > 50. (Ghana) . . . . . ***adpressus*** (p. 30)

10 With the head in full-face view the lateral margins between the eyes and the occipital corners equipped with a continuous row of short, freely projecting hairs . . 11

– With the head in full-face view the lateral margins between the eyes and the occipital corners without a row of short, projecting hairs. If one or two hairs are present they are minute and do not project freely beyond the margins. (West and Central Africa) . . . . . ***tardus*** (p. 27)

11 Dorsum of petiole transversely rugose, the first gastral tergite very finely and densely longitudinally arched-rugulose, the rugulae converging upon the midline at least anteriorly, and often subcircular in organization. (West and Central Africa, Uganda) . . . . . ***kohli*** (p. 22)

– Dorsum of petiole not transversely rugose; the first gastral tergite predominantly finely and densely reticulate-punctate. A few basigastric rugulae may be present as may a few rugulae upon the disc, but the sculpturation not as above. . . . 12

12 Postpetiole divided into two lobes by a strong, median longitudinal cleft dorsally. Lateral pronotal margins without differentiated, projecting teeth. (Cameroun, Zaire) . . . . . ***lobatus*** (p. 23)

– Postpetiole not divided into two lobes by a median longitudinal cleft dorsally. Lateral pronotal margins with one or two differentiated projecting teeth . . 13

13 Lateral pronotal margins each with two teeth. Propodeal spines relatively long, about as long as the petiole. (Central Africa, Kenya) . . . ***pullus*** (p. 26)

– Lateral pronotal margins each with a single tooth situated close to the acute humeral angles. Propodeal spines relatively short, shorter than the length of the petiole. (Zaire) . . . . . ***theobromicolus*** (p. 28)

14 Head exceptionally long, distinctly much longer than broad, CI < 80. (Madagascar) ***tenuis*** (p. 37)

– Head not as remarkably elongate, CI > 85, often CI > 100 15

15 Head, alitrunk and pedicel dorsally with strong, undulate, longitudinal sulci, finer upon the head than on the alitrunk. A few short, clavate hairs present on the dorsal alitrunk. (Madagascar) . . . . . ***porcatus*** (p. 25)

– Sculpturation not as above, usually rugose or reticulate-rugose with reticulate-punctate interspaces. If the dorsal alitrunk is sulcate then either the head is differently sculptured or the alitrunk hairs are simple 16

16 At least the hairs on the clypeus strongly clavate, spatulate, stalked-suborbicular or otherwise bizarre, usually also on the remainder of the cephalic dorsum. In the majority of cases the apex of each hair is strongly swollen whilst the stem is narrow. Eyes relatively large, OI > 48 17

– All hairs on the clypeus and the remainder of the cephalic dorsum simple, usually short, stout and blunt but sometimes minute, sometimes very long and curved; rarely are they gradually increased in thickness from base to apex. If the last then the eyes are relatively smaller, OI < 47 18

17 Lateral pronotal margins with a tooth at the humeral angle and another at the junction of pro- and mesonotum; the margin between these two teeth without denticles or projecting hairs, smooth and very shallowly concave. (Nigeria, Zaire) . . . . . ***vorticus*** (p. 38)

– Lateral pronotal margins with a row of small or minute denticles between the humeral angle and the tooth at the promesonotal junction; and with numerous projecting hairs. (Widespread in Africa) . . . . . ***brevisetosus*** (p. 31)

18 In dorsal view the posterolateral portion of the pronotal margin produced into a spine or triangular prominence. Head relatively broad or very broad, the eyes small, CI > 112, OI < 30 19

– In dorsal view the posterolateral portion of the pronotal margin not produced as above but usually armed with a short tooth or denticle. When a short tooth is present in this position it is usually comparable in size to others upon the pronotal margin. Head relatively narrow, the eyes large, CI 110 or less, OI > 32 . . . 20

19 Sculpturation of dorsal alitrunk a very distinct rugoreticulum with reticulate-punctate interspaces. Lateral margins of mesonotum usually with one or more denticles. (West and Central Africa) . . . . . ***erinaceus*** (p. 52)

– Sculpturation of dorsal alitrunk variable in intensity but consisting essentially of a longitudinal rugation or sulcation which may be irregular or sinuate. Lateral margins of mesonotum usually without denticles. (West and Central Africa) ***guineensis*** (p. 55)

20 Erect hairs on dorsal surfaces of head, alitrunk, pedicel and gaster abundant, dense, very long, narrow and fine, often curved or even sinuate 21

– Erect hairs on dorsal surfaces of head, alitrunk, pedicel and gaster relatively sparse, short, broad, blunt and coarse, never sinuate 22

21 Propodeal dorsum longitudinally rugulose or rugose. Larger species, HL > 0·90, HW > 0·85 with a relatively long alitrunk, AL 1·00 or more. (Ghana, Angola) ***elongatus*** (p. 34)

– Propodeal dorsum transversely rugulose. Smaller species, HL < 0·90, HW < 0·85, with a relatively short, broad alitrunk, AL ca 0·80. (Zaire) . . ***pilosus*** (p. 35)

22 First gastral tergite coarsely longitudinally rugose on the disc in the anterior one-third of its length; posteriorly the rugae on the disc running transversely. (Madagascar: Grand Comoro Is.) . . . . . ***voeltzkowi*** (p. 50)

– First gastral tergite variously sculptured but never with longitudinal rugae anteriorly and transverse rugae posteriorly upon the disc 23

23 Posterior one-quarter of first gastral tergite coarsely longitudinally rugose, rugulose or striate; this sculpturation always distinct, usually extending to the apex of the tergite, sometimes extending the length of the segment 24

– Posterior one-quarter of first gastral tergite reticulate-punctate or finely superficially sculptured and shining; a few fine, scattered longitudinal rugulae formed by fusion of the margins of aligned punctures may be present 27

24 Dorsal alitrunk and first gastral tergite finely and regularly longitudinally sulcate-rugose throughout their lengths. Smaller species, HW < 0·90 with relatively large eyes, OI > 49. (Zaire, Kenya) . . . . . ***striativentris*** (p. 36)

– Dorsal alitrunk reticulate-rugose, reticulate-punctate or both. First gastral tergite not regularly sulcate-rugose throughout its length, usually with puncturation,

at least on median portion of disc. Larger species, HW > 0·95 with relatively smaller eyes, OI < 47 25

25 Mesonotum reticulate-punctate. First gastral tergite densely and deeply longitudinally striate on the posterior quarter, the preceding half-length of the tergite finely reticulate-punctate. CI 98 or less. (Madagascar) . ***ebrardi*** (p. 41)

– Mesonotum with a rugoreticulum overlying the reticulate-puncturation, the former may be very coarse, masking the latter which is usually best developed on the centre of the disc. First gastral tergite sometimes striate or rugose throughout its length. CI 98 or more (usually > 100) 26

26 Dorsal surfaces of head and alitrunk with numerous conspicuous, relatively long hairs. Sculpturation of dorsal alitrunk a fine and spaced rugoreticulum overlying a fine, dense reticulate-puncturation. Eyes relatively somewhat larger, OI 41 or more. (Mozambique, South Africa) . . . . . ***wissmanni*** (p. 51)

– Dorsal surfaces of head and alitrunk with relatively few inconspicuous short hairs. Sculpturation of dorsal alitrunk variable; usually a coarse, dense rugulation or rugoreticulum but the rugae may be reduced. Very rarely the mesonotum shagreened, with large foveolae. Eyes relatively somewhat smaller, OI 34 to 40. (South and East Africa, Madagascar) . . . . ***intrudens*** (part) (p. 42)

27 Occiput with a distinct transverse groove above the foramen. In profile the mesonotum separated from the propodeal dorsum by a short but distinct step; propodeal dorsum approximately flat and on a lower level than the mesonotum. (Uganda) . . . . . ***impressus*** (p. 35)

– Occiput without a transverse groove above the foramen. In profile the mesonotum forming a more or less continuous and uninterrupted convex surface with the propodeal dorsum 28

28 Tooth on mesokatepisternum large, long and acute, projecting anterolaterally and clearly visible in dorsal view, projecting beyond the marginations of the mesonotum 29

– Tooth on mesokatepisternum small and short, usually a mere tubercle or acute angle; in dorsal view this tooth not or only very little visible 30

29 Vertex of head meeting occiput in an acute angle; the first gastral tergite very finely reticulate or reticulate-punctate. Larger species, HW > 0·95, PW > 0·75 with relatively small eyes, OI < 45 and the head as broad as or broader than long, CI 100 or more. (South Africa) . . . . . ***micans*** (p. 46)

– Vertex of head running into occiput through a continuous curve, the two surfaces not separated by an acute angle. First gastral tergite coarsely reticulate-punctate. Smaller species, HW < 0·85, PW < 0·70 with relatively large eyes, OI > 50 and the head longer than broad, CI < 95. (Dahomey) . . . ***difficilis*** (p. 33)

30 Subpetiolar process complex, anteroventrally with a prominent, broadly rounded angle and posteroventrally with an extended heel or spur. Postpetiole with a strongly developed simple, digitiform ventral process 31

– Subpetiolar process simple, a rectangular or subrectangular lobe without the above configuration or with an acute angle or small tooth posteroventrally; if the latter then the postpetiole without a strongly developed digitiform ventral process. . 32

31 Larger species, HL > 1·00, HW > 1·00, PW > 1·00 with relatively broader head and smaller eyes, CI > 100, OI < 45. Propodeal spines very strongly developed, long, stout, acute and divergent. Posterolateral portion of pronotal margination expanded into a low, broadly triangular extension with denticulate borders. (Zaire) . . . . . ***greggi*** (p. 54)

– Smaller species, HL < 1·00, HW < 0·95, PW < 1·00 with relatively narrower head and larger eyes, CI < 100, OI > 50. Propodeal spines acute but short and poorly developed. Posterolateral portion of pronotal margination not expanded as above. (West and Central Africa, Kenya) . . . . . ***weissi*** (p. 39)

32 Smaller species, HW < 1·10, PW < 0·90 33

– Larger species, HW > 1·10, PW > 0·90 34

33 Head longer than broad, CI < 100, with slightly larger eyes, OI 41 or more. Lateral pronotal margins with a regular row of denticles, the margination itself not strongly expanded. First gastral tergite with a few longitudinal rugulae in the middle of the disc. (Widespread in Africa) . . . . ***pygmaeus*** (p. 48)

– Head broader than long, CI > 105, with slightly smaller eyes, OI 41 or less. Lateral pronotal margins with a few irregular, rounded, tuberculiform teeth, the margination itself strongly expanded. First gastral tergite reticulate-punctate in the middle of the disc, without rugulae. (South Africa) . ***fricatidorsus*** (p. 42)

34 Short erect hairs thickly abundant on all dorsal surfaces, especially conspicuous upon the head, where they are very dense. Head relatively somewhat narrower, CI 102 or less, the eyes slightly larger, OI 40 or more. (Zaire) . ***bequaerti*** (p. 40)

– Short erect hairs very sparse and scattered, often virtually absent from the dorsal head and alitrunk. Those present on the dorsal head, pronotum and mesonotum, especially the head, are very short and inconspicuous. Head relatively somewhat broader, CI 103 or more, eyes slightly smaller, OI 40 or less. (South and East Africa, Madagascar) . . . . . ***intrudens*** (part) (p. 42)

The *HUBERI*-Group

Small to very large species (TL 4·0 – 11·0 approx.) in which the head is always short and broad, and always broader than long (CI > 100), with a measured range of CI 101–132. The eyes are relatively small or very small, usually with OI < 30, but in *regularis* and in some individuals of *egenus* they may be larger, up to OI 35.

The dorsum of the head capsule behind the clypeus and the dorsal alitrunk are completely devoid of hairs except in *porcatus* where a few short, clavate hairs are present on the latter. Marginal hairs, projecting laterally are common amongst the species on the head and alitrunk. The pronotum is marginate laterally, often strongly so, more rarely the margination is reduced (*oberthueri*) but in no case is it denticulate; although in some species the margin is produced into one or two distinct teeth. Propodeal spines are usually long, stout and acute, but one species lacks such spines (*inermis*). Sculpturation throughout the group is predominantly of a fine and dense reticulate-puncturation with an overlying very weak rugulation or a rugoreticulum. Exceptions are known and in the case of *regularis* and its immediate allies a marked longitudinal sulcation is developed.

In some species of the group large workers are developed which may, if taken singly, appear to belong to separate species as they tend to differ from more usual-sized individuals in details of structure and sculpturation. Some of the synonymy in the group is based upon the description of single specimens of such species, where usually the larger individual is given one name and the smaller another name, for example *coriaceus* and *pullus*; *tardus* and *schoutedeni*. When good series have been acquired the differences between such large and small forms have been nullified.

A number of closely related species pairs occur within the group. For instance *lobatus* and *inermis* share the same development of the postpetiole, with a dorsal longitudinal groove dividing the segment; *egenus* and *huberi* have the same form of petiolar and gastral development; and *regularis* and *porcatus* have longitudinal sulci as their basic sculpturation. The group contains 12 species, of which 4 are peculiar to the Malagasy region. The species are distributed through the forest zones of the two regions, usually in the rain forests of West and Central Africa and eastern Madagascar but also in areas of drier forest.

Cataulacus egenus Santschi

(Text-fig. 1)

Cataulacus egenus Santschi, 1910 : 359, fig. Holotype worker, CONGO (BRAZZAVILLE): Madingou (*R. P. Zimmermann*) (NM, Basle) [examined].

Cataulacus egenus st. *simplex* Santschi, 1914*b* : 111, fig. 18. Holotype worker, UGANDA: Central Region, i. 1909 (*Ch. Alluaud*) (location of type not known). **Syn. n.**

Worker. TL 4·2–6·1, HL 1·10 – 1·48, HW 1·22 – 1·74, CI 101 – 120, EL 0·40 – 0·48, OI 27 – 33, IOD 1·00 – 1·48, SL 0·62 – 0·80, SI 46 – 52, PW 1·14 – 1·60, AL 1·32 – 1·76, MTL 0·66 – 0·88 (10 measured).

Occipital crest variously developed; either complete or incomplete medially or absent, the last occurring usually in small workers. When the crest is well developed it is little more than an acute angle separating the vertex from the occiput. Occipital corners with a dentiform angle projecting somewhat laterally or the corners merely acutely angled. Sides of head behind eyes smooth and regular, not denticulate nor crenulate. Pronotum marginate laterally, not denticulate, the margination not or only slightly expanded, either simple and following the shape of the segment or with a small, bluntly rounded dentiform process anteriorly. Remainder of alitrunk not marginate and not denticulate, the dorsum rounding smoothly into the sides. Propodeum with a pair of long, acute, slightly divergent spines. Dorsal alitrunk usually without sutures or with the location of the promesonotal suture indicated by a very faint impression. Rarely the metanotal groove is also indicated by an extremely faint marking upon the dorsum. Petiole with the dorsal surface strongly transverse, rectangular or subrectangular in shape; postpetiole also expanded transversely. First gastral tergite marginate basally and for part of the length of the sides; this structure paralleled on the sternite laterobasally by a raised ridge or carina.

Sculpturation of dorsum of head a fine, dense and very shallow reticulate-puncturation which is often more or less effaced, the whole overlaid by a fine, irregular, usually disorganized rugoreticulum. Pronotal dorsum usually similar to the head with the puncturation more distinct, especially upon the anterior half. Remainder of dorsal alitrunk finely reticulate-punctate with numerous very fine rugulae. These are predominantly longitudinal in direction but often a reticulum is present in places. On the propodeal dorsum the rugulae tend to diverge posteriorly towards the bases of the spines and rarely are they transverse upon the dorsum. Declivity of propodeum usually with some transverse rugulae, at least between the spines. Petiole and postpetiole coarsely transversely rugose or sulcate-rugose, the gaster densely reticulate-punctate with a few longitudinal rugulae.

Erect hairs absent from all dorsal surfaces of head, alitrunk, pedicel and gaster, but a few may be present upon the lateral margins of the head. The appendages bear numerous hairs.

Female. TL 6·6 – 7·0, HL 1·40 – 1·50, HW 1·42 – 1·58, CI 101 – 105, EL 0·44 – 0·48, OI 30 – 31, IOD 1·20 – 1·34, SL 0·72 – 0·76, SI 48 – 50, PW 1·34 – 1·50, AL 1·88 – 1·92, MTL 0·76 – 0·88 (3 measured).

Answering the description of the worker but with the usual thoracic modifications. Occipital crest usually developed as an angle. Pronotal marginations less distinct, propodeal spines reduced to a pair of short, broad and blunt teeth. Sculpturation basically as worker but the mesoscutellum may lack rugulae and the propodeal dorsum is usually transversely rugulose. The female of this species was first described by Wheeler (1922*a* : 199).

Male. TL 5·1 – 5·5, HL 0·92 – 1·00, HW 1·10 – 1·16, CI 116 – 119, EL 0·36, OI 31 – 32, IOD 0·90 – 0·96, SL 0·48 – 0·50, SI 42 – 43, PW 1·00 – 1·02, AL 1·58 – 1·68, MTL 0·82 – 0·86 (2 measured).

Occipital crest not present, the occipital corners dentiform. Sides of head behind eyes with one or two denticulae. A pair of small, shallow impressions present upon the vertex, situated just behind and laterad of the posterior ocelli, and almost in a straight line between this and the median (anterior) ocellus. Pronotum weakly marginate laterally, the sides almost straight, not denticulate. Anterior arms of notauli developed and cross-ribbed, fading out

medially; the posterior arm absent. Propodeum with a pair of short, broad but acute spines. Segments of pedicel in dorsal view developed as in the worker, but less strongly so. First gastral tergite not marginate, the sternite without a carina.

Sculpturation of head reticulate-punctate in the vicinity of the ocelli, but elsewhere also with sparse rugulation which tends to form a reticulum in places. Pronotal dorsum similar to the last, with a marked rugoreticulum; the sclerites of the mesonotum predominantly reticulate-punctate, with few or no rugulae. Propodeal dorsum coarsely rugose; the segments of the pedicel with marked transverse rugae, especially the petiole. Gaster finely and densely reticulate-punctate. Erect hairs sparse upon the head and alitrunk, numerous on the gaster.

This species is most closely related to *huberi*, sharing the same pedicellar and gastral development, but is separated from it by the characters given in the key. Nests of *egenus* have been found in rotten branches of cocoa trees which are still attached to the trunk. The workers forage actively upon the bark and leaves, but the feeding habits of the species remain unknown.

MATERIAL EXAMINED.

GHANA: Bunso (*D. Leston*); Tafo (*D. Gibbs*). NIGERIA: Gambari (*B. Bolton*); Owena (*J. T. Medler*). UGANDA: n. Buddu (*S. A. Neave*); Nkosi I. (*G. D. H. Carpenter*). ZAIRE: Medje (*H. O. Lang*); Medje (*Bequaert*); Basongo (*H. Schouteden*); Kasai, Ngombe (*H. Schouteden*); Stanleyville (*L. Burgeon*); Luebo, Kamaiembi (*H. Schouteden*); Luebo, Macaco (*H. Schouteden*); Congo da Lemba (*R. Mayné*); Yangambi (*N. L. H Krauss*).

Cataulacus huberi E. André

(Text-figs 10, 11)

Cataulacus huberi E. André, 1890 : 326. Syntype workers, SIERRA LEONE (*A. Mocquerys*) (MNHN, Paris) [examined].

Cataulacus huberi var. *longispinus* Stitz, 1910 : 139, fig. 8. Holotype worker, CAMEROUN: Mundame (*Conradt*) (MNHU, Berlin) [examined]. **Syn. n.**

Cataulacus huberi race *herteri* Forel, 1913*c* : 315. Syntype workers, ZAIRE: Katanga, Welgelegen 14.vi.1912 (*Bequaert*) (MHN, Geneva; MRAC, Tervuren; MNHU, Berlin) [examined]. **Syn. n.**

Cataulacus huberi subsp. *guilelmi* Wheeler, 1925 : 1. Holotype worker, ZAIRE: Ituri (location of type not known). **Syn. n.**

Cataulacus huberi st. *herteri* var. *luebensis* Santschi, 1937*a* : 57. Syntype workers, ZAIRE: Luebo, Kamajembi, 22.ix.1921 (*H. Schouteden*) (NM, Basle) [examined]. [Name not available.]

Worker. TL 5·5 – 7·8, HL 1·22 – 1·74, HW 1·60 – 2·30, CI 127 – 132, EL 0·42 – 0·56, OI 26 – 29, IOD 1·20 – 1·84, SL 0·76 – 1·04, SI 45 – 48, PW 1·28 – 2·10, AL 1·44 – 2·10, MTL 0·86 – 1·24 (10 measured).

Occipital crest usually developed as an unarmed ridge or acute angle separating vertex from occiput. In shape it may be broadly but shallowly concave across the width of the head or more strongly concave in the middle portion than elsewhere. The crest may be reduced or even absent in some smaller members of the species. Occipital corners acute, usually without a posteriorly projecting tooth but with a laterally projecting dentiform angle. Sides of head behind eyes usually denticulate or crenulate, rarely only irregular. Pronotum strongly marginate laterally, the margination either entire or more usually broken up into 1 to 4 separated,

projecting dentiform or blunted processes, sometimes the number of these processes different on each side of the same individual. When the margination is entire then the edge is often crenulate or otherwise jagged. Remainder of alitrunk not marginate, without denticles. Propodeum with a pair of long, acute spines. Dorsal surface of petiole flattened, rectangular or subrectangular in shape, the sides of the posterior face converging. Postpetiole strongly transversely expanded, usually distinctly broader than the petiole. Subpetiolar process well developed, variable in shape and size; subpostpetiolar process usually a long, acute tooth. Both the tergite and the sternite of the first gastral segment strongly or very strongly marginate or carinate laterobasally, these structures tending to fade out before reaching the midlength of the segment.

Sculpturation very variable. The head is usually finely and sparsely reticulate-rugose with reticulate-punctate interspaces, more rarely with the rugulations adopting a longitudinal or arcuate direction. On the dorsal alitrunk all intergrades are known between a distinct longitudinal sulcate-rugulation and a finely shagreened surface with one or two weak rugulae. However, the most common form of sculpturation appears to be a very fine and quite dense longitudinal rugulation with the spaces between the rugulae reticulate-punctate. On the anterior portion of the pronotum the rugulae tend to be transverse. Petiole and postpetiole strongly transversely sulcate-rugose. First gastral tergite usually densely reticulate-punctate, often with numerous longitudinal rugulae, especially basally.

Erect hairs absent from dorsal surfaces of head and body, present upon appendages and with a row of distinct short hairs freely projecting laterally beyond the margins of the sides of the head behind the eyes.

Female. TL 8·0, HL 1·70, HW 2·00, CI 116, EL 0·54, OI 27, IOD 1·68, SL not measurable, PW 1·80, AL 2·30, MTL 1·12.

Answering to the description of the worker but the pronotal marginations not so broadly expanded and the rugulation of the mesoscutellum and propodeum strongly transverse. Propodeal spines greatly reduced in length, present here as a pair of broad, blunt teeth. The female may in fact be as variable as the worker, but collections of this caste are extremely scarce.

Male. TL 6·8, HL 1·20, HW 1·42, CI 118, EL 0·40, OI 28, IOD 1·16, SL 0·66, SI 46, PW 1·36, AL 1·94, MTL 1·02.

Occipital crest absent, the occipital corners projecting as broadly triangular processes. Sides of head behind eyes strongly denticulate. Sides of pronotum sharply but narrowly marginate, not expanded as in the worker, nor armed with teeth. Anterior arms of notauli well developed and strongly cross-ribbed, the posterior arm absent. Parapsidal furrows very distinct. Propodeum with a pair of long, acute spines which are very broad basally. Petiole and postpetiole basically similar in shape to that described for the worker, with similar ventral processes. A faint trace of margination is visible on the first gastral tergite in front of the spiracle, and a short weak carina parallels it upon the sternite. Sculpturation is everywhere of a fine, dense reticulate-puncturation with a few scattered rugulae, which form a loose reticulum behind the eyes. The propodeal dorsum is more strongly rugose and the segments of the pedicel show sculpturation similar to, though less well developed than the worker. Short erect hairs are present and distinct upon the dorsal surfaces of the alitrunk and gaster, but are limited to two upon the vertex.

Without a doubt *huberi* is amongst the most variable of species as concerns sculpturation. At the beginning of this survey I had originally separated two of the most extreme forms as distinct species, and it was only with the study of more material, as it was acquired, that it became apparent that only a single species was represented. Although the species is so variable it is nonetheless easily recognizable by its combination of the following characters: pedicellar segments transverse and strongly transversely sculptured; gaster with the first tergite strongly

marginate and the first sternite carinate laterobasally; sides of head denticulate or crenulate, with a distinct series of projecting hairs.

The most closely related species, *egenus*, is separated by the characters given in the key. Of the described, and now synonymized infraspecific taxa formerly attached to *huberi*, the majority were based upon sculptural variations, and these immediately fell into the synonymy. In the var. *longispinus*, apart from some sculptural variation, Stitz noted that there were three prothoracic spines on each side and relatively long propodeal spines. The latter are well within the range observed during the present study and as has been noted the number of pronotal spines or teeth may vary from 0 to 4. In fact the race *herteri*, reported by Forel as having no teeth upon the pronotum, has two such processes developed in at least two of the syntype workers in existence.

The specimens of this species collected by the present author were found running upon a moss-covered tree trunk in Ghanaian primary forest. Collections by pyrethrum knock-down in this area (Mt. Atewa) conducted by D. Leston also produced this species.

MATERIAL EXAMINED.

GHANA: Mt. Atewa (*B. Bolton*), (*D. Leston*), (*O. W. Richards*); Mampong (*O. W. Richards*). NIGERIA: Ile-Ife (*J. T. Medler*). UGANDA: no data, 1 specimen. ZAMBIA: N'Changa (*C. T. Macnamara*); Congo Border, Niankasa (*H. S. Evans*). ZAIRE: Ituri, Mt. Hoyo (*E. S. Ross & R. E. Leech*); Lubulu (*L. Burgeon*); Haut Uele, Moto (*L. Burgeon*); Irebu (*H. Schouteden*); Basongo (*H. Schouteden*) Kai Bumba (*H. Schouteden*); Kamaiembi (*H. Schouteden*); Kunungu (*H. Schouteden*); Yangambi (*N. L. H. Krauss*).

Cataulacus inermis Santschi

Cataulacus inermis Santschi, 1924 : 218, fig. 10. Holotype worker, ZAIRE: Kasai, Ngombe, 5.xi.1921 (*H. Schouteden*) (MRAC, Tervuren) [examined].

Worker. TL 6·1, HL 1·50, HW 1·74, CI 116, EL 0·50, OI 29, IOD 1·42, SL 0·84, SI 48, PW 1·60, AL 1·82, MTL 1·00.

Occipital crest not developed medially, the vertex separated from the occiput by a sharp angle. Occipital corners forming a blunt right-angle, without a tooth or denticle. Sides of head behind eyes not denticulate. Pronotum strongly marginate laterally, the margins expanded and quite regular, not denticulate. Remainder of alitrunk not marginate not denticulate, the propodeum without spines or teeth posterodorsally, the dorsum curving without interruption into the declivity. Petiole more or less flat dorsally; the postpetiole divided into two lobes dorsally by a median longitudinal impression. First gastral tergite marginate basally and laterally to the level of the spiracle, behind which the margination peters out.

Dorsal surfaces of head and alitrunk very finely and densely reticulate-punctate. On the head there is some faint rugoreticulation, best developed behind the eyes. Pronotum and mesonotum with sparse, scattered, very faint and predominantly longitudinal rugulae. Propodeal dorsum and declivity distinctly and regularly transversely rugulose. Dorsum of petiole and anterior face of postpetiole strongly, rather coarsely longitudinally sulcate. First gastral tergite finely and very densely reticulate-punctate with a scattered rugoreticulum.

Erect hairs absent from alitrunk and from dorsum of head except for a row running between the eyes and the occipital corners and some upon the frontal carinae. Petiole and postpetiole with sparse, very stout hairs; first gastral tergite without hairs except for a few at the apex.

The structure and sculpturation of the pedicel ally this species very closely with *lobatus*, from which it is separable by its lack of propodeal spines and presence of transverse sculpturation upon the propodeal dorsum. In *lobatus* propodeal spines are present and the sculpturation of the dorsum of the segment is longitudinal where developed.

Cataulacus kohli Mayr

(Text-fig. 8)

Cataulacus kohli Mayr, 1895 : 127, fig. 2. Holotype worker, SIERRA LEONE: N'Gamie River, Samlia Falls (location of type not known).

Cataulacus kohli st. *brazzavillensis* Santschi, 1909 : 389, fig. 14. Syntype workers, male, CONGO (BRAZZAVILLE): Brazzaville (*A. Weiss*) (NM, Basle) [examined]. **Syn. n.**

Cataulacus foveolatus Stitz, 1910 : 140. Holotype worker, EQUATORIAL GUINEA: Uelleburg (*Tessmann*) (MNHU, Berlin) [examined]. **Syn. n.**

Cataulacus latipes Menozzi, 1932 : 106, fig. 4. Syntype workers, UGANDA: Entebbe (*E. Bayon*) (IE, Bologna). **Syn. n.**

Worker. TL 5·1 – 7·1, HL 1·24 – 1·74, HW 1·64 – 2·28, CI 126 – 132, EL 0·48 – 0·60, OI 26 – 29, IOD 1·22 – 1·90, SL 0·74 – 1·04, SI 41 – 45, PW 1·52 – 2·14, AL 1·40 – 2·10, MTL 0·84 – 1·30. (5 measured).

Occipital crest developed as a low but sharp, unarmed ridge running the width of the head and separating vertex from occiput. It is better developed in larger than in smaller workers, and is concave in its median portion. Occipital corners rounded, without teeth or denticles; the sides of the head behind the eyes not denticulate. Alitrunk not denticulate on the lateral margins. Humeral angles of pronotum rounded, not produced into a point; the shape of the pronotal margination somewhat variable but usually with a broad, rounded, subtriangular process anteriorly, subtended by a simple ridge posteriorly. The process is almost a broad and much-flattened tooth in smaller workers but is less well developed in larger individuals. Mesonotum and propodeum not marginate, the latter armed with a pair of long, acute, tapering spines. Dorsum of alitrunk without trace of sutures or with the promesonotal suture faintly indicated. In the largest workers the path of the metanotal groove may be visible, but is always extremely faint and is never impressed. Femora, especially of the hind legs, strongly antero-posteriorly compressed, narrow and very deep. First gastral tergite weakly or not marginate laterally. When margination is distinctive it is strongest basally, petering out well before the apex of the segment.

Sculpturation of dorsum of head capsule usually finely granulose with scattered, superimposed shallow pits or foveolae. Laterally, close to and behind the eyes are some fine rugulations which tend to curve towards the midline of the occipital margin. Rarely, and usually in smaller workers, these rugulae are also present in the centre of the dorsum. Alitrunk, especially the mesonotum and propodeum, finely and densely reticulate-punctate with fine, scattered longitudinal rugulae. Pronotal dorsum more variably sculptured, the rugulae may even run transversely on the anterior portion. Petiole transversely rugose; the anterior face of the postpetiole longitudinally rugose. First gastral tergite finely and densely reticulate-punctate, overlaid by dense, very fine, virtually parallel rugulations which are arranged in a broadly circular or oval pattern around the sclerite or are convergent on the midline anteriorly.

Dorsal surfaces of head, alitrunk and gaster without hairs. Hairs are abundant upon the legs and a row of very short, blunt hairs projects from the lateral margins of the head behind the eyes. Lateral pronotal margins without such a projecting series of short hairs.

This quite distinctive medium-sized species is mostly confined to the rain forest areas of West and Central Africa, but does occur in East African forests. The strongly flattened hind femora, form of sculpturation and lack of dorsally situated hairs coupled with a complete absence of denticles render this species quite easily recognizable.

The name *foveolatus*, used by Stitz to describe this species, really only applies to the sculpturation of the dorsum of the head capsule, but this sculpturation is not more strongly defined in his specimen than is usual in the species. The name *latipes* laid emphasis upon the strongly expanded hind femora which are characteristic of the species. As Menozzi noted that the species was 'unique' and was separable from all other species by the 'special sculpture of the body and the much-dilated femora', it seems reasonable to assume that he was not acquainted with either Mayr's original description or Stitz's later description of the species. Menozzi's characterization and figures of the worker make the synonymy certain.

MATERIAL EXAMINED.

CAMEROUN: Okola (*C. A. Collingwood*); Nkolbisson (*B. de Miré*). ZAIRE: Haut Uele, Watsa (*L. Burgeon*); Haut Uele, Moto (*L. Burgeon*); Basongo (*H. Schouteden*); Kasai, Ngombe (*H. Schouteden*); Kunungu (*H. Schouteden*); Luebo (*H. Schouteden*); Ilenge (*R. Mayné*); Mongende (*H. Schouteden*); Kidada, Kitobola (*H. Schouteden*); Eala (*H. Schouteden*); Bali (*Christy*); Ituri, La Moto, Madyu (*L. Burgeon*); Yangambi (*N. L. H. Krauss*).

Cataulacus lobatus Mayr

(Text-fig. 9)

Cataulacus lobatus Mayr, 1895 : 126, fig. 1. Holotype worker, CAMEROUN: Kriegsschiffhafen, 15.iii.1892 (*Brauns*) (MN, Vienna) [examined].

Note: the holotype is badly damaged, with both the head and the gaster missing.

Worker. TL 6·1, HL 1·52, HW 1·76, CI 116, EL 0·48, OI 27, IOD 1·46, SL 0·88, SI 57, PW 1·56, AL 1·80, MTL 1·04.

Occipital crest developed at each side but almost obliterated medially, visible only from certain angles, shallowly concave, unarmed. Occipital corners acute, almost right-angular but without differentiated teeth or denticles. Sides of head behind eyes irregular but not denticulate. Pronotum marginate, the margins expanded laterally but without teeth or denticles. Remainder of alitrunk not marginate, without denticles. Track of promesonotal suture represented upon the dorsal alitrunk by an extremely faint impression. Propodeum with a pair of short, narrow but acute spines. Petiole in dorsal view distinctly longer than broad; postpetiole divided into a pair of lobes dorsally by a longitudinal median impression. Sides of first gastral tergite marginate to the level of the spiracle; the margination most acute basally, rapidly becoming more obtuse nearer the spiracle itself.

Dorsum of head behind clypeus very finely reticulate-punctate with a faint, loose overlying rugoreticulum. The latter is strongest and most distinct behind the eyes but is very much

effaced medially, in places virtually absent. Dorsal alitrunk similarly sculptured, the punctuation more marked than upon the head, and the sides of the propodeal dorsum with a few longitudinal rugae converging upon the bases of the spines. Propodeal declivity strongly transversely rugose throughout its depth. Dorsal surfaces of petiole and postpetiole coarsely longitudinally sulcate-rugose. First gastral tergite strongly reticulate-punctate with a few short rugulae.

Erect hairs absent from dorsal surfaces of head, alitrunk and gaster; present on the lateral margins of the head and the appendages.

C. inermis is the closest related species to *lobatus*, but the former lacks propodeal spines and has distinctive transverse sculpturation upon the propodeal dorsum as well as the declivity.

MATERIAL EXAMINED.

ZAIRE: Mulubule (*J. Bequaert*).

Cataulacus oberthueri Emery

(Text-fig. 7)

Cataulacus oberthüri Emery, *in* Forel, 1891*a* : 146, pl. 4, fig. 9. Syntype workers, MADAGASCAR: Tamatave and Alaha Kato (*E. Perrot*) (MRAC, Tervuren) [examined].
Cataulacus oberthueri Emery; Emery, 1899 : 186 [emended spelling].

Worker. TL 10·8, HL 2·48, HW 2·76, CI 111, EL 0·60, OI 21, IOD 1·74, SL 1·54, SI 56, PW 1·84, AL 3·2, MTL ca 1·90.

Occipital corners extended posteriorly into a very broadly triangular, acute prominence on each side. In profile these projections are seen to be slightly upcurved. Occipital crest unarmed, incomplete medially where the vertex rounds smoothly into the occiput, but laterally the crest is strongly developed, somewhat translucent, and forming a strong inner border to the occipital prominences. Sides of the head behind eyes not denticulate, the actual margin of the head in full-face view semi-translucent between the posterior margin of the eye and the apex of the prominence at the occipital corner. Preocular teeth absent. Pronotum with a weakly developed, transverse ridge anteriorly, and virtually non-existant lateral margination, the latter represented only by an obtuse angle, best seen on the posterior half of the segment. Remainder of alitrunk not marginate; the entirety of the alitrunk without denticles, spines or lobiform prominences laterally. Propodeum with a pair of long, tapering, acute spines. Track of promesonotal suture indicated by a very shallow, faint impression upon the dorsum. Petiole and postpetiole in profile with low, rounded nodes, paniform, each with a short, spiniform ventral process anteriorly. First gastral tergite without margination.

Dorsal surfaces of head, alitrunk and pedicel finely shagreened throughout with some sparse, fine, longitudinal rugation, especially visible and strongest developed upon the head and the propodeal dorsum. First gastral tergite superficially extremely finely and densely reticulate, dully shining.

Upon the dorsal surfaces of the body stout hairs are present only on the frontal carinae, pedicel and apex of first gastral tergite; they are, however, numerous upon the appendages.

This species is characterized by its large size, relatively very small eyes and its reduction or loss of numerous 'typically cataulacine' features. The remarkably developed occipital corners led Forel (1891*a* : 147) to place *oberthueri* in a separate subgenus *Otomyrmex*. now synonymized (see above, p. 7).

The species appears to be related to two other Madagascan species, *regularis* and *porcatus* and these, with the possible inclusion of *wasmanni*, seem to represent a more ancient radiation upon the island. It should be noted that specialization in these species has been accomplished by a reduction of characters considered typical of the genus as a whole, and this tendency reaches its strongest development in *oberthueri*. The entirety of the head and alitrunk is devoid of denticulation and almost devoid of standing hairs; the margination of the alitrunk is reduced almost to nothing, with only a vestige remaining on the pronotum; and sculpturation everywhere is strongly reduced. Preocular teeth are absent and the posterior portions of the antennal scrobes are very poorly developed.

The species is apparently rare, only being known from the forested areas in the vicinity of Tamatave on the east coast of Madagascar, and from a locality thirty miles to the north-west of this town.

Cataulacus porcatus Emery

Cataulacus porcatus Emery, 1899 : 286. Syntype worker, female, MADAGASCAR: Antongil Bay, 1897–98 (*Mocquerys*) (probably in MCSN, Genoa).

I have not been able to examine the types of this interesting species and as far as can be ascertained the type collection represents the only known specimens. However, Emery's description is good and the species appears to be valid. The short characterization given below is summarized from the original description.

Worker. TL 3·5 – 4·5.

Occipital corners with two small, obtuse teeth each and the occipital crest apparently absent. Preocular teeth present. Dorsal surface of head strongly convex so that the large eyes are more or less lateral; antennal scrobes strongly deflected in their posterior portions. Alitrunk marginate; the pronotal margination with two subrectangular teeth anteriorly, separated by an incision. Behind this the margin is feebly sinuate and terminates in a broad, rounded projection. Mesonotum separated from propodeum by a tooth and an incision laterally. Propodeum furnished with a pair of short spines. Promesonotal suture effaced, metanotal groove a faint sulcus which does not break the sculpturation. Petiole with a small tooth in the middle of its upper sides.

Head, alitrunk and segments of pedicel with strongly undulate, longitudinal sulcate-rugation; with only 12–13 present across the posterior portion of the mesonotum. Sculpturation of head finer than that of alitrunk and some rugae are convergent towards a point on the midline situated on a level with the anterior margins of the eyes. Gaster finely punctate and with fine, longitudinal rugae.

A few short, clavate hairs present upon the alitrunk and legs.

Emery states that the species is close to *regularis*, and from the description this certainly appears to be the case. In particular his description of the alitrunk and sculpturation are reminiscent of *regularis* (Text-fig. 14), but as he points out there are noticeable differences in the sculpturation, and also *regularis* has the occipital corners unarmed. In view of this it is probably correct to retain *porcatus* as a species, at least until the types can be examined or until more material assignable to the species is forthcoming.

Cataulacus pullus Santschi
(Text-fig. 12)

Cataulacus pullus Santschi, 1910*a* : 387, fig. 13. Holotype worker, CONGO (BRAZZAVILLE): Brazzaville (*A. Weiss*) (NM, Basle) [examined].

Cataulacus coriaceus Stitz, 1910 : 138, fig. 7. Holotype worker, CAMEROUN: Mundame (*Conradt*) (MNHU, Berlin) [examined]. **Syn. n.**

Cataulacus pullus var. *orientalis* Santschi, 1914*b* : 108. Holotype worker, KENYA: Voi, alt. 600 m, st. no. 60, iii. 1912 (*Alluaud & Jeannel*) (NM, Basle) [examined]. **Syn. n.**

Worker. TL 5·3–7·0, HL 1·32–1·84, HW 1·58–2·16, CI 117–119, EL 0·42–0·54, OI 25–28, IOD 1·18–1·70, SL 0·80–1·02, SI 49–53, PW 1·24–1·60, AL 1·60–2·04, MTL 0·90–20 (3 measured).

Occipital crest absent, the vertex curving into the occipital surface which is shallowly concave in larger workers. Occipital corners with a single, broad triangular or subtriangular denticle or tooth, which is usually continued towards the midline as a short, sharp ridge. Sides of head between eyes and occipital corners denticulate or crenulate or merely irregular in largest workers. Pronotum marginate laterally, the remainder of the alitrunk not marginate, the dorsum curving into the sides. On the pronotum the margination is expanded laterally, beginning just behind the acute humeral angles, and usually bears two teeth. The anterior of these two teeth is larger and is separated by a distinct gap from the posterior teeth; this latter is situated towards the posteriormost point of the pronotal margination, which peters out before the junction with the mesonotum. Promesonotal suture absent or its track marked by an extremely faint impression, showing its former position. Propodeum with a pair of long, acute slightly divergent spines. Ventral processes of petiole and postpetiole well developed, the former usually showing a well developed posteroventral tooth or spur; the latter short, spiniform or dentiform. First gastral tergite not marginate laterally.

Dorsum of head extremely finely, densely and shallowly reticulate-punctate, dully shining; the whole surface except the clypeus overlaid by a fine, loose, disorganised rugoreticulum. Pronotum, especially on anterior half, sculptured as head, but on the remainder of the dorsal alitrunk the rugulae tend to take on a distinct longitudinal trend. In smaller workers the rugulae may be reduced or absent on the mesonotum, leaving the sclerite merely reticulate-punctate. Petiole and postpetiole coarsely rugose, the rugae often directed longitudinally upon the former. First gastral tergite reticulate-punctate or also with a fine rugoreticulum.

Erect hairs absent from dorsal surfaces of head behind clypeus and dorsum of alitrunk, present upon clypeus, lateral margins of head, pedicel, appendages, and usually also on first gastral tergite.

The variety *orientalis* was based on very slight differences of sculpturation and form of propodeal spines from the type of *pullus*. Stitz's species *coriaceus* is the 'large form' of worker which is now known to occur in most species of this group, occasionally with marked differences in structure or sculpturation. It is possible that the description of *coriaceus* was already in press when Santschi published *pullus*, as Stitz does not appear to have been acquainted with this latter paper.

The species is perhaps best distinguished by the characters used to separate it in the key. In the specimens so far examined the structure of the pronotal margination has been reasonably consistent; but in view of the variability of this region in closely related species (*huberi*, etc.) it is to be expected that specimens will eventually be found which differ in this respect from the above description.

MATERIAL EXAMINED.

ZAIRE: Irebu (*H. Schouteden*), Lukolela to Basoko (*H. O. Lang*).

Cataulacus regularis Forel
(Text-fig. 14)

Cataulacus regularis Forel, 1891*b* : 252. Syntype workers, MADAGASCAR: Bezanozano, Anosibé (*Sikora*) (MHN, Geneva) [examined].

Worker. TL 5·3 – 5·9, HL 1·22 – 1·32, HW 1·30 – 1·32, CI 100 – 107, EL 0·42 – 0·46, OI 32 – 35, IOD 1·04 – 1·06, SL 0·68 – 0·72, SI 52 – 54, PW 1·10 – 1·18, AL ca 1·68, MTL 0·66 – 0·70 (2 measured).

Lateral portions of occipital crest developed, unarmed. Medially the crest is very poorly developed, concave or broadly V-shaped in full-face view. Sides of head behind eyes smooth, not denticulate. Occipital corners irregular or with one or two obtuse, low prominences, not armed with teeth or spines. Sides of alitrunk without denticles. Humeral angles acute, separated by a short but marked concavity from the beginnings of the pronotal margination; the latter joining the mesonotum at a slight notch. Promesonotal suture visible as an impression across the sculpturation but not breaking it. Mesonotal margination ending in a triangular, dentiform process posteriorly, in front of a distinct notch separating mesonotum from propodeum. Propodeal marginations strongly convex anteriorly, converging behind to a pair of short, narrow, virtually parallel spines. Petiole longer than broad in dorsal view, with a small but distinct laterally projecting tooth at about the midlength on either side. In profile the petiole somewhat flattened, with a steep anterior face and a long, somewhat sloping dorsal face; without a differentiated free posterior surface before the junction with the postpetiole. Subpetiolar process complex, with a tooth posteroventrally. Anterior subpostpetiolar process variable in size but simple. Sides of postpetiole in dorsal view with one or two denticles. Gaster not marginate laterally.

Dorsal surfaces of head behind clypeus, alitrunk, petiole and postpetiole strongly sculptured with regular, parallel longitudinal sulci, the spaces between the sulci broadly convex and giving the cuticle a ploughed appearance. The pronotal sulci are slightly wavy in the larger specimen examined, much more regularly organized in the smaller. First gastral tergite finely reticulate-punctate with a few scattered, fine, longitudinal rugulae. Clypeus sculptured much as rest of head but more finely so, and with a tendency for the sulci to fade out anteriorly.

Dorsal surfaces of head and alitrunk and margins of alitrunk without hairs. Short hairs are present upon the petiole, postpetiole, apex of first gastral tergite and margins of frontal carinae; appendages with numerous short, erect hairs.

This very distinctively shaped and sculptured species is apparently known only from the type collection made in Madagascar. In the original description Forel records that Anosibé is three days journey east-south-east of Antananarivo. The sculpturation seen in this species is very uncommon, being met with only in one other Madagascan species, the seemingly closely related *porcatus*. This latter species is, however, smaller and has some erect hairs on the dorsal alitrunk, besides differences in sculpturation. In species of other groups in which at least the alitrunk is longitudinally sulcate there are other marked differences, most obvious amongst which are presence of hairs or denticles or both upon the alitrunk, and marked differences in the shape of this portion of the body.

Cataulacus tardus Santschi
(Text-fig. 13)

Cataulacus tardus Santschi, 1914*c* : 372, fig. 33. Holotype worker, GUINEA: Mamou, 24.viii.1912 (*Silvestri*) (NM, Basle) [examined].

Cataulacus schoutedeni Santschi, 1919*b* : 248. Syntype workers, female, ZAIRE: Congo da Lemba, i–ii.1913 (*R. Mayné*) (NM, Basle; MRAC, Tervuren) [examined]. **Syn. n.**

Worker. TL 5·4 – 6·8, HL 1·40 – 1·70, HW 1·58 – 1·96, CI 113 – 117, EL 0·44 – 0·54, IO 22 – 28, IOD 1·20 – 1·48, SL 0·84 – 0·98, SI 50 – 51, PW 1·24 – 1·56, AL 1·54 – 1·86, MTL 0·88 – 0·94 (7 measured).

Occipital margin usually without crest separating vertex from occiput, the two surfaces confluent; but in some large workers an acute angle separates the two surfaces. Occipital corners without teeth or denticles, rounded; the sides of the head behind the eyes often irregular but never denticulate. Margins of alitrunk not denticulate; the pronotum strongly marginate, the remainder not marginate, with the dorsum rounding evenly into the sides. Pronotal margination expanded laterally, subrectangular in shape, the edges straight or irregular and strongly converging posteriorly to the mesonotal surface. Promesonotal suture absent or represented in the largest workers by a very faint and extremely shallow arcuate impression. Propodeum with a pair of long, strong, acute spines, as long as or longer than the dorsal length of the petiole. First gastral tergite not marginate.

Dorsum of head extremely finely, densely and faintly reticulate-punctate, with a loose, very fine, scattered rugoreticulum. In some specimens the rugulation is effaced or nearly so over some areas of the cephalic dorsum. Dorsal alitrunk similarly sculptured but with the rugulae tending to assume a longitudinal direction. First gastral tergite predominantly or totally finely reticulate-punctate, but in some specimens a few very faint rugulae are visible.

Dorsal surfaces of head, alitrunk and gaster without hairs. Margins of head behind eyes and margins of alitrunk without hairs, or the former with one or two minute hairs which, however, do not project freely beyond the margin.

The syntype female of *schoutedeni* described by Santschi (1919*b* : 249) has not been examined during the course of this study but from the rather short description it does not appear to differ significantly from the worker. The sculpturation is noted as being rather more coarse and the head as being slightly longer. TL is given as 6 mm.

Santschi notes that *schoutedeni* is close to *tardus*, but 'is smaller, the (propodeal) spines relatively longer, the sculpture more feeble'. Variations of this form are usual and may be universal amongst species of the *huberi* group, and the only real difference separating the types of the two forms in the present species (apart from obvious size differences) is the presence of an angle separating the vertex from the occiput in *tardus*, absent from *schoutedeni*. As has been noted the occurrence of this angle is restricted to large workers of the species and no grounds remain for maintaining the two names as separate species.

MATERIAL EXAMINED.

GHANA: Tafo (*C. A Collingwood*); S. Fomang (*D. Leston*); Osiem (?). ZAIRE: Kwamouth (*H. Schouteden*); Kunungu (*H. Schouteden*); Temvo (*H. Schouteden*); Mayumbe, Makaia Ntete (*H. Schouteden*).

Cataulacus theobromicolus Santschi

Cataulacus theobromicolus Santschi, 1939*a* : 8, fig. 2. Holotype worker, ZAIRE: Gazi, in cocoa tree, xii. 1937 (*Beinaert*) (location of type not known).

The short diagnostic notes below are adapted from the original description.

Worker. TL 6·5, CI 118, OI 27 (CI and OI are approximated from the figure accompanying the original description).

Occipital corners with a single tooth; the occipital margin not denticulate and apparently without an occipital crest of any form. Sides of head behind eyes crenulate posteriorly, close to the corners. Pronotum marginate laterally, the anterior and posterior angles of the margins acute but not projecting. Pronotal margins without denticles but with a single triangular tooth in the anterior halves of their lengths. Mesonotum and propodeum not marginate, without denticles. Promesonotal suture and metanotal groove feebly marked by impressions. Propodeal spines short but acute.

Entirety of head and body dorsally finely reticulate-punctate, the head and alitrunk with a fine rugoreticulum which is finer and denser upon the alitrunk than upon the head. Petiole dorsally very coarsely longitudinally rugose. Sides of head behind eyes with a row of laterally projecting short, stout hairs. Hairs absent from dorsum of head and alitrunk; present around mouth and at apex of gaster.

The overall impression obtained from Santschi's description and figure is of a species closely related to *pullus* but separated from it by the structure of the lateral pronotal margins and the relative shortness of the propodeal spines.

Cataulacus wasmanni Forel

Cataulacus (*Otomyrmex*) *wasmanni* Forel, 1897 : 193. Holotype worker, MADAGASCAR: Isle Ste. Marie, Kalalo (location of type not known).

I have not been able to locate the type of this species but the original description is sufficiently detailed to allow its recognition as a good species. This description is in part reproduced below, the arrangement somewhat altered to fit the format used in the present paper.

Worker. TL 5·3.

Occipital crest developed. Occipital corners with short, fairly small, triangular, ear-shaped points. Eyes very large, flat. Sides of head behind eyes apparently not denticulate. Preocular tooth present. In profile the dorsal outline of the alitrunk hemispherically arched. Pronotum marginate, not denticulate, the margin sharp, horizontal and leaf-like. Mesonotum and propodeum with a horizontal, broad, short thorn or strong tooth. Promesonotal suture indicated by an impression. Propodeum with a pair of very long, acute, divergent spines, which are half as long as the entire alitrunk. Gaster short, elliptical, almost round in dorsal view.

Head densely and coarsely, regularly longitudinally rugose dorsally. Occipital surface behind the crest transversely rugose. Pronotum coarsely, densely longitudinally striate; the mesonotum similarly but very regularly striate. Propodeal dorsum transversely striate, the sides longitudinally so; similarly the segments of the pedicel. Gaster reticulate-punctate with fine but not dense longitudinal striation. Hairs absent from the dorsal surfaces of the head and body, present on the appendages, the anterior portion of the head and mandibles, and the gastral apex.

The description of the sculpturation and form of the alitrunk seems to ally this species to *oberthueri* and its allies, particularly to *regularis*. It should be easily recognizable as it is the only Madagascan species on record in which the direction of sculpturation differs on the propodeum from that on the mesonotum. This arrangement of sculpture is known from two species of the Ethiopian region, namely *inermis* and *pilosus*, but in the first of these the propodeum lacks spines, whilst the second is densely hairy.

The *TENUIS*-Group

Small to minute species, TL usually less than 4·0, rarely slightly more; measured range o TL 2·7 – 4·4, the latter occurring only in large workers of *elongatus*. Slender, narrowly built forms with HW < 1·0, often <0·90 and with PW < 0·80. The head is always longer than broad, CI < 100 and in most cases less than 95. Eyes relatively large or enormous, OI usually >50, always 49 or more except in *elongatus* where one worker measured had OI 45.

Hairs are invariably present on the dorsal surfaces of the head, body and appendages. These hairs are usually short, stout and simple but in some species they are variously modified; for instance at least the cephalic hairs may be clavate (*brevisetosus*, *vorticus*), or long and sinuate (*elongatus*), or short, simple and very strongly adpressed (*adpressus*). The pronotum is marginate laterally, the sides usually almost parallel, and in most species the margins are serially denticulate. The propodeal spines are usually short and acute, not uncommonly somewhat dorsoventrally flattened. Sculpturation in the group is basically of a rugoreticulum with reticulate-punctate interspaces, but numerous species have longitudinal rugulation or sulcation, at least in part.

This group of ten species includes all the small, narrowly-built, large-eyed forms with elongate heads. They are very closely related to the *intrudens*-group, from which they may eventually be found to be inseparable.

The common species *pygmaeus* apparently forms a link between the two groups but on weighing the characters which it possesses it falls in with *intrudens* rather than with the relatives of *tenuis*. However, as it resembles the members of the present group so closely and as one of the species included in this group was originally described as an infraspecific form of *pygmaeus*, separatory notes and comments are included under some of the species.

The majority of species in the present group are forest-dwelling forms but *brevisetosus* seems able to survive in any area of Africa in which conditions are not too inimical. Only a single species of the group, *tenuis* itself, is found in Madagascar.

Cataulacus adpressus sp. n.

(Text-figs 15, 18)

Holotype worker. TL 3·5, HL 0·90, HW 0·82, CI 91, EL 0·44, OI 54, IOD 0·58, SL ca 0·42, SI ca 50, PW 0·69, AL 0·90, MTL 0·44.

Occipital crest absent; occipital corners each armed with a single low, blunt denticle. Sides of head behind eyes uneven but not denticulate, convergent close to the occipital corners. Preocular tooth small, separated from the eye by a small gap. Pronotum marginate laterally, the humeral angles acute; margination with a number of extremely minute denticles and terminating posteriorly in a single larger denticle close to the promesonotal junction. Mesonotum and propodeum not marginate, without denticles; propodeal spines short and bluntly rounded apically. Promesonotal suture represented upon the dorsum by a very weak impression which does not break the sculpturation and is best visible at the sides where it joins a small, shallow notch separating the pro- and mesonota. Metanotal groove absent. Sides of pronotum in dorsal view more or less parallel, only very slightly convergent posteriorly; those of the mesonotum shallowly convex and convergent posteriorly, separated from the propodeum by a shallow, very broadly V-shaped impression. Propodeal sides with a bluntly convex swelling anteriorly, converging behind to the bases of the spines. First gastral tergite not marginate laterally.

Dorsum of head finely reticulate-rugose, the interspaces finely and densely reticulate-punctate. Dorsum of alitrunk finely regularly longitudinally sulcate with a few transverse sulci between the propodeal spines. Sides of alitrunk obliquely sulcate, those on the propodeum almost vertical. Femora longitudinally sulcate. Anterior surface of petiole and posterior surfaces of both petiole and postpetiole transversely sulcate, but the anterior and dorsal faces of the latter longitudinally so. First gastral tergite with fine, dense longitudinal rugulae throughout its length.

Hairs on all dorsal surfaces of the body from the clypeus to the apex of the first gastral tergite strongly adpressed, sparse, most easily visible upon the clypeus, propodum, postpetiole and gaster. Normal standing hairs present only upon the mandibles, margins of the frontal carinae and extreme gastral apex. A few strongly adpressed hairs present upon the dorsal surfaces of the femora.

Holotype worker, GHANA: Bunso (eastern region), 8.vii.1969, by pyrethrum knockdown (*D. Leston*) (BMNH).

The combined characters of size, sculpturation, and the remarkable adpressed hairs immediately identify this species and serve to separate it from the other species related to *brevisetosus*.

Cataulacus brevisetosus Forel

(Text-figs 3, 17, 20)

Cataulacus brevisetosus Forel, 1901*b* : 305. Holotype worker, ANGOLA: Mossamedes, Cubango-Cuito (location of type not known).

Cataulacus lujae Forel, 1911*a* : 311. Syntype workers, ZAIRE: Kasai, Kondue (*Luja*) (MRAC, Tervuren) [examined]. **Syn. n.**

Cataulacus lujae var. *gilviventris* Forel, 1913*c* : 316. Holotype female, ZAIRE: Kabanza, Kikondja, Riv. Lovoi (*Bequaert*) (MRAC, Tervuren) [examined]. **Syn. n.**

Cataulacus jeanneli Santschi, 1914*b* : 108, fig. 16. Holotype worker, KENYA: Gazi, 20 km south of Mombasa (st. no. 6), xi. 1911 (*Alluaud & Jeannel*) (NM, Basle) [examined]. **Syn. n.**

Cataulacus pygmaeus st. *degener* Santschi, 1916 : 507. Holotype worker, ANGOLA: Loanda, 14.i.1913 (NM, Basle) [examined]. **Syn. n.**

Cataulacus pygmaeus st. *lujae* var. *plebeja* Santschi, 1916 : 508. Syntype workers, RHODESIA: Bulawayo, ix. 1914 (*G. Arnold*) (NM, Basle) [examined]. [Name not available.]

Cataulacus janneli (sic) var. *loveridgei* Santschi, 1926 : 244. Holotype worker, TANZANIA: Morogoro, 21.xi.1917 (*A. Loveridge*) (location of type not known). **Syn. n.**

Cataulacus meduseus Santschi, 1939*b* : 245. Holotype worker, SOUTH AFRICA: Natal, Durban, 24.i.1917 (*C. P. Merve*) (possibly in NMR, Bulawayo). **Syn. n.**

Worker. TL 2·7 – 4·0, HL 0·76 – 1·08, HW 0·68 – 0·98, CI 86 – 95, EL 0·36 – 0·48, OI 49 – 54, IOD 0·50 – 0·72, SL 0·36 – 0·50, SI 51 – 53, PW 0·54 – 0·78, AL 0·74– 1·10, MTL 0·38 – 0·52 (20 measured).

Occipital crest absent, the vertex rounding into the occiput or separated from it by an obtuse angle. Occipital corners denticulate and a second denticle present on the occipital margin close to the corner. Sides of head behind eyes minutely denticulate in most, but in some individuals the denticles are reduced or absent. Alitrunk marginate laterally, the margination most pronounced upon the pronotum. Pronotal margins with a row of small or minute denticles, a few of which are also present upon the mesonotal and propodeal margins and may occasionally be present on the outer borders of the propodeal spines; the latter short but distinct. Dorsal alitrunk without trace of sutures. Subpetiolar process simple or with an acute posteroventral angle which may very rarely project as a short tooth. Subpostpetiolar process simple, projecting

ventrally as a short blunt spine and usually about half the length of the subpetiolar process. Gaster not marginate laterally.

Dorsum of head and pronotum finely and densely reticulate-rugose with densely reticulate-punctate interspaces. Remainder of dorsal alitrunk similarly sculptured or the rugulae tending to take a longitudinal direction. More rarely the rugulae are reduced upon the mesonotum and propodeal dorsum. Dorsal surface of petiole and also usually of the postpetiole longitudinally rugose. First gastral tergite finely and densely reticulate-punctate everywhere or with sparse longitudinal rugulae present at the base of the gaster only.

Hairs on the clypeus and usually also upon the remainder of the cephalic dorsum bizarre, short and stout and either strongly clavate or stalked-suborbicular, more rarely rather spatulate. In some cases the hairs may be strongly clavate anteriorly upon the head but more or less simple posteriorly. Hairs on remainder of body numerous, short and stout but simple.

Female. TL 4·6 – 5·0, HL 1·04 – 1·10, HW 0·92 – 0·96, CI 87 – 90, EL 0·46, OI 48 – 50, IOD 0·70 – 0·74, SL 0·48 – 0·52, SI 52 – 54, PW 0·86 – 0·90, AL 1·40 – 1·42, MTL 0·48 – 0·54 (3 measured).

As worker but with the expected modification of the alitrunk for flight. Sculpturation of mesoscutum and scutellum of fine, longitudinal rugulation and strong reticulate-puncturation. Propodeal dorsum rather more coarsely rugose than in worker, the spines shorter.

The interrelationships and the constituent species of the complex centring on *brevisetosus* are difficult to decide owing to the great variation in details of sculpturation and shape met with in individuals. The great majority of the forms included in the above synonymy were originally separated from one another only on minor details of head shape, petiole node shape, lengths of propodeal spines and variation in size, all of which characters are very variable, often between individuals of the same colony. Workers from each end of the size range of a series collected at Adeiso, Ghana by D. Leston would earlier this century probably have been described as separate varieties or subspecies if collected singly. The size range between the largest and smallest workers in this series is HL 0·76 – 1·00, HW 0·68 – 0·90, (CI 89 – 90), EL 0·36 – 0·44, (OI 49 – 51), PW 0·54 – 0·70, AL 0·74 – 1·04; coupled with which are some variations in sculpturation and in shape. Because of this variability it is probable that some very closely related forms may be present in the species now called *brevisetosus*, but which are not recognizable as separate as the amount of material available at present is not great enough to show up any consistent characters which they may have. A reassessment of all the forms now placed in *brevisetosus* at some future date when more material is available may show the species to be in actuality a complex of very closely related but distinct forms.

The close relationship of many of the forms of the *brevisetosus* complex was recognized by most earlier workers, in fact Forel (1915 : 220) placed his own species *lujae* as a subspecies of *brevisetosus*, a move with which Arnold (1917 : 397) seemed to agree. On the other hand Santschi (1916 : 506–508) attempted to resolve the problematical forms by placing them all as infraspecific forms of *pygmaeus*. The present study indicates that this was not justifiable, and of the names given as stirps, races and varieties of *pygmaeus*, namely *difficilis*, *lujae*, *plebeja*, *weissi*, *degener*, *jeanneli* and *brevisetosus* the first, fourth and last are now treated as good species whilst the remainder have been placed in the synonymy of the last. Arnold (1917 : 396) pointed out that the differences used to separate *plebeja* were slight and came within the limits of variation to be found in a single nest.

There is a possibility that some specimens of *pygmaeus* may be confused with *brevisetosus* as the clypeal and cephalic hairs in the former are occasionally thickened from base to apex and under low magnification may appear clavate. In these cases the identity of the specimen may be confirmed by mensurable characters, as the head in *pygmaeus* is usually broader (CI 94 – 97) than in specimens of *brevisetosus* with approximately similar head length, whilst the eyes are always relatively smaller, OI 41 – 46, as opposed to OI 49 – 54 in *brevisetosus*. Other absolute measurements will also give an indication of identity as only the largest *brevisetosus* individuals overlap the smallest *pygmaeus* workers in size. Also, the rugoreticulum on the pronotal dorsum is usually more coarse and more widely spaced in *pygmaeus* and the interspaces of this sculpturation tend to be less strongly punctate and are usually distinctly glossy.

Arnold (1917 : 398) records this species nesting in hollow twigs of an acacia. The species has also been noted by the present author nesting in hollow twigs of cocoa in both Nigeria and Ghana, and in the former nests are also made in twigs on small shrubs as well as high up in larger trees.

MATERIAL EXAMINED.

LIBERIA: Monrovia (?). GHANA: Pankese (*C. A. Collingwood*); Akosombo (*C. A. Collingwood*); Domfen (*C. A. Collingwood*); Tafo (*B. Bolton*); Mampong (*D. Leston*); Legon (*D. Leston*); Enchi (*D. Leston*). NIGERIA: Gambari (*B. Bolton*); Araromi (?). ZAIRE: Barumbu (*Bequaert*); Eala (*Couteaux*); Tshela (*E. S. Ross* and *R. E. Leech*). KENYA: Kibwesi (*E. S. Ross*). RHODESIA: Bulawayo (*G. Arnold*); Salisbury (*G. Arnold*). SOUTH AFRICA: Magalieskraal (*Lingnau*); Kimberley (*Power*).

Cataulacus difficilis Santschi **stat. n.**

Cataulacus pygmaeus st. *difficilis* Santschi, 1916 : 506. Holotype worker, DAHOMEY (*Desanti*) (NM, Basle) [examined].

Worker. TL 3·3, HL 0·86, HW 0·78, CI 91, EL 0·42, OI 54, IOD 0·58, SL ·44, SI 56, PW 0·64, AL 0·90, MTL not measurable.

Occipital crest absent; occipital corners each with a pair of small but acute, triangular teeth, one situated at the corner itself, the second just internal to it upon the occipital margin. Sides of head behind the large eyes relatively short but strongly denticulate. Sides of pronotum marginate, strongly denticulate, the remainder of the alitrunk more weakly and sparsely denticulate. Propodeum with a pair of short, acute, divergent spines. Dorsal alitrunk without trace of sutures. Mesokatepisternal tooth strongly developed, triangular, acute and projecting distinctly when the alitrunk is viewed from above. Subpostpetiolar process long and digitiform (subpetiolar process obscured by glue on type). First gastral tergite not marginate laterally.

Dorsum of head finely and shallowly recticulate-rugose, the rugae becoming longitudinal anteriorly. The interspaces of the rugoreticulum sparsely and very shallowly reticulate-punctate, shining, in places the puncturation almost effaced. Pronotal dorsum similarly sculptured but on the mesonotum and propodeal dorsum the cross-meshes are lost, so that the

rugae run longitudinally. First gastral tergite strongly and rather coarsely reticulate-punctate, much more strongly so than the head or dorsal alitrunk.

Stout, blunt, erect hairs present upon all dorsal surfaces, simple, relatively long and most abundant upon the head.

Santschi originally associated this species with *pygmaeus*, but the development of the mesokatepisternal tooth in the type (and only known) worker quickly separates this form. In proportion to the overall size of the individual this tooth is almost as well developed as in the better known species *micans*. Furthermore, the dimensions and characteristics of the species show it to be more closely related to *brevisetosus* than to *pygmaeus*.

Cataulacus elongatus Santschi

Cataulacus elongatus Santschi, 1924 : 221. Holotype worker, ANGOLA: Loanda (*Le Moult*) (NM, Basle) [examined].

Worker. TL 3·7 – 4·4, HL 1·00 – 1·10, HW 0·92 – 0·98, CI 89 – 92, EL 0·42 – 0·48, OI 45 – 49, IOD 0·68 – 0·74, SL 0·54 – 0·60, SI 58 – 61, PW 0·60 – 0·72, AL 1·00 – 1·12, MTL 0·52 – 0·58 (4 measured).

Occipital crest absent; occipital corners with a small tooth or denticle and with a second denticle on the border, close to the first. Sides of head behind eyes irregular or crenulate, but not distinctly denticulate. Development of preocular tooth variable, usually distinct but may be reduced. Sides of pronotum virtually parallel, minutely denticulate behind the acute humeral angles. Sides of alitrunk convergent behind the pronotum, often irregular but not denticulate, the mesonotum not marginate. Dorsum of alitrunk without sutures; propodeum armed with a pair of short spines. First gastral tergite not marginate laterally.

Dorsum of head with a fine, loose rugoreticulum, the interspaces of which are shallowly and weakly reticulate-punctate and shining. Dorsum of alitrunk with numerous fine, dense, rounded longitudinal rugae, almost sulcate in appearance; this sculpturation more irregular on the pronotum than elsewhere. Dorsum of petiole regularly, transversely arched-rugulose, the anterior face of the segment with a few weak transverse rugules. Posterior face of postpetiole as petiole, the dorsum rather more coarsely longitudinally rugose. First gastral tergite predominantly finely and densely reticulate-punctate, but with numerous fine or very fine irregular longitudinal rugulae.

All dorsal surfaces of head, body and appendages with abundant fine, long, narrow hairs which are usually curved or sinuate. Hairs on the vertex tend to curve forwards whilst those on the rest of the body are predominantly back-curved.

Female. TL 4·7, HL 1·10, HW 0·96, CI 87, ELo·46, OI 46, IOD 0·74, SL 0·62, SI 64, PW 0·84, AL 1·30.

As worker but propodeal spines proportionally shorter and the denticulation of the pronotum less well marked. Sculpturation strongly longitudinal on all dorsal sclerites of alitrunk except the propodeum where it appears to be transverse (obscured by glue on specimen). Petiole strongly U- or V-shaped rugulose, the base of the V being posterior.

The abundant long, curved or sinuate, relatively soft hairs which clothe this species make it immediately recognizable amongst its congeners. The closest related known species appears to be *pilosus* but this may be distinguished by its shorter, more stocky alitrunk and marked sculptural differences. The lateral denticulations of the pronotum in *elongatus* are very small and may be overlooked in smaller specimens.

MATERIAL EXAMINED.

GHANA: Bunso (*D. Leston*).

Cataulacus impressus sp. n.

Holotype worker. TL 3·7, HL 0·90, HW 0·86, CI 96, EL 0·46, OI 53, IOD 0·64, SL 0·44, SI 51, PW 0·70, AL 0·98, MTL 0·46.

Occipital crest absent, the occiput and vertex meeting in a smoothly convex curve. Occipital surface just above the foramen with a marked transverse groove or impression, behind which the remaining thin strip of the occiput juts out over the dorsal portion of the foramen itself. Occipital corners each with a single denticle and flanked internally upon the occipital margin by a larger and more conspicuous denticle. Sides of head behind eyes sparsely and minutely denticulate. Clypeal suture demarcated by a strongly impressed arc. Pronotum strongly marginate laterally, the margins sparsely equipped with small, broadly triangular denticles. Mesonotum and propodeum more weakly marginate than pronotum, denticulate, the propodeum armed with a pair of long, broad, dorsoventrally flattened spines which are nearly parallel, only slightly divergent posteriorly. In dorsal view the sides of the pronotum are parallel, the alitrunk becoming narrower at the mesonotum and again at the propodeum. In profile the posterior portion of the mesonotum curves abruptly downwards to the surface of the propodeum so that the more or less flat surfaces of the two are separated by a short but distinct step. Subpetiolar process apparently with a prominent, rounded anteroventral angle and an acute posteroventral angle which is not, however, produced into a spur. Subpostpetiolar process developed, digitiform, simple. First gastral tergite not marginate laterally.

Head with a fine rugoreticulum, the interspaces of which are finely but shallowly reticulate-punctate and shining. Dorsal alitrunk finely longitudinally rugose, the individual rugae widely separated (i.e. distance separating rugae is greater than the width of the individual rugae), the interspaces finely reticulate-punctate and shining. Cross-meshes very sparse upon the dorsum but present in places. Posterior face of petiole with a few very weak transverse rugulae, otherwise the pedicel irregularly finely rugulose and reticulate-punctate. First gastral tergite finely and quite superficially reticulate-punctate, shining.

All dorsal surfaces of head, body and appendages with numerous stout, erect, blunt hairs.

Holotype worker, UGANDA (without further data) (MCZ, Boston).

This small but aberrant species is immediately recognizable by the shape of the alitrunk in profile and the presence of a transverse groove upon the occipital surface just dorsal to the foramen.

Cataulacus pilosus Santschi

Cataulacus pilosus Santschi, 1920 : 118. Syntype worker, female, ZAIRE: Avakubi, 6.1.1914 (*Bequaert*) (NM, Basle) [examined].

Worker. TL 3·1, HL 0·82, HW 0·80, CI 97, EL 0·40, OI 50, IOD 0·64, SL 0·44, SI 55, PW 0·56, AL 0·82, MTL 0·40.

Occipital crest absent; occipital corners armed with one or two denticles which are not much larger than those on the sides of the head behind the eyes. Preocular tooth relatively large and triangular. Eyes widely separated, the surface beween them convex. Margins of alitrunk irregular but not denticulate, although one or two minute, tuberculiform denticulae may be present just posterior to the acute humeral angles. In the syntype worker these are better developed on the right hand side than on the left. Propodeum armed with a pair of very short spines. In dorsal view the sides of the pronotum are virtually parallel, but behind this they converge posteriorly. However, there is no abrupt, sharp-angled narrowing behind the pronotum. Dorsal alitrunk without sutures or vestiges of sutures. First gastral tergite not marginate laterally.

Dorsum of head covered with a fine rugoreticulum, the interspaces of which are densely reticulate-punctate. Pronotal dorsum similarly sculptured but on the mesonotum the cross-

meshes are lost, and this area is closely and distinctly longitudinally rugose, almost sulcate-rugose; the constituents somewhat wavy, especially towards the outer margins of the sclerite. Propodeum with fine, dense, arched-transverse rugulation, similarly the posterior face of the petiole and the postpetiole. Dorsum of postpetiole with a few short, longitudinal rugae. First gastral tergite finely and densely but brokenly and unevenly longitudinally rugulose, with reticulate-punctate interspaces.

Entirety of dorsum, but especially the head, abundantly equipped with long, fine, erect hairs, many of which are curved.

This short and rather stocky species can immediately be recognized by the presence of dense, long, fine hairs on all dorsal surfaces of the body, and by the transverse sculpturation upon the propodeum, a combination of characters not shared with any other known species. The erect hairs are in fact noticeably longer than is normal in the genus and, proportional to their length, they are also much finer.

The female of the species was described by Santschi in the same publication as the worker (on page 119) and appears to be essentially similar in form, with the mesoscutum and scutellum longitudinally striate-rugose.

Bequaert (1922) records the species as nesting in the myrmecophilous plant *Cuviera angolensis* Hiern.

Cataulacus striativentris Santschi **stat. n.**

Cataulacus wissmanni var. *striativentris* Santschi, 1924 : 219. Syntype workers, Zaire: Ubanghi, Banzyville (*R. P. Augustin*), and Haut Uele, Moto, 1920 (*L. Burgeon*) (NM, Basle; MRAC, Tervuren) [examined].

Cataulacus donisthorpei Santschi, 1937*a* : 61. Syntype workers, Kenya: nos. 17 and 42 (H. Donisthorpe coll.) (BMNH) [examined]. **Syn. n.**

Worker. TL 3·6 – 3·7, HL 0·90 – 0·94, HW 0·86 – 0·88, CI 93 – 95, EL 0·44 – 0·45, OI 50 – 51, IOD 0·62 – 0·64, SL 0·48, SI 54 – 56, PW 0·70, AL 0·94 – 0·96, MTL 0·50 (2 measured).

Occipital crest absent, the two surfaces meeting in a continuous curve. Occipital corners with a single tooth and with a second, smaller tooth beside them on the occipital border. Sides of head behind eyes finely denticulate. Sides of pronotum denticulate, the posteriormost denticle being the largest in the series. Sides of mesonotum and propodeum each with one or two denticulae; the dorsal alitrunk without trace of sutures. Propodeum bispinose, the spines rather short, broad and divergent. The pronotum is quite strongly expanded laterally and is noticeably broader than the remainder of the alitrunk. Node of petiole virtually pointed above when viewed in profile, the anterior and posterior faces sloping steeply away. Subpetiolar process with a developed posteroventral tooth, heel or spur. Subpostpetiolar process simple, long. First gastral tergite not marginate laterally.

Dorsal surface of head coarsely reticulate-rugose in the space between the eyes, and behind the eyes. In front of the anterior margin of the eyes the cross-meshes of the rugoreticulum tend to be lost, leaving this area and the clypeus longitudinally rugose. The interspaces of the occipital sculpturation are very finely and densely reticulate-punctate, and dully shining. Dorsum of alitrunk longitudinally sulcate-rugose, the sculpturation tending to be less well organized and regular on the anterior pronotum than elsewhere. Petiole and postpetiole longitudinally rugose dorsally; the first gastral tergite very closely and densely longitudinally rugose or sulcate-rugose throughout its length.

Simple, erect, blunt hairs numerous on all dorsal surfaces of the head, body and appendages. Margins of head and alitrunk with hairs projecting laterally from the marginal denticles.

This small, large-eyed species is separable from similarly sculptured forms by the presence of hairs upon the dorsal surfaces of the head and body which although numerous cannot be termed abundant and are not very elongate nor sinuate. The disorganized sculpturation of the posterior half of the head capsule contrasts strongly with the regular sulcate-rugulation of the alitrunk. The form described as *donisthorpei* is, on the whole rather less coarsely sculptured than is the type of *striativentris*, and the pronotum less regularly sculptured, but otherwise the two are alike.

Santschi's original association of *striativentris* with *wissmanni* was based upon his use of Forel's description of the latter species in which the characterization of the sculpturation of the alitrunk is inaccurate. Forel (1894 : 79) gives the alitrunk as being 'irregularly longitudinally rugose' when it is, for the greater part, distinctly reticulate-rugose with strongly punctured interspaces. Santschi stated that 'sculpturation not distinctly reticulate-punctate between the ridges of the thorax', which is of course correct for *striativentris*, but the inaccuracy of the original description of *wissmanni* hid the fact that the two sculpturations are fundamentally different.

Cataulacus tenuis Emery

Cataulacus tenuis Emery, 1899 : 288. Holotype female, MADAGASCAR: Antongil Bay, 1897–98 (*Mocquerys*) (possibly in MCSN, Genoa).

I have not been able to examine the type of this species, nor have I seen the worker which was described by Santschi (1913 : 310) and was based upon a single individual recovered by J. de Gaulle in Madagascar, at an unnamed location. However, the two descriptions are so similar in their salient features that Santschi appears to have correctly associated his single worker with the type female.

Both descriptions stress the fact that the head is about one quarter longer than it is wide. This gives a CI in the region of 75, by far the lowest yet recorded in the genus. If this is so then the species can be easily recognized on that single character plus the fact that it is restricted to Madagascar, but the following features are also of note.

Worker. TL 3·5. Occipital corners projecting as broad teeth; the sides of the head behind the eyes without denticles. Sides of alitrunk marginate, denticulate; the propodeum with a pair of short spines. Head and alitrunk longitudinally rugose with an irregular reticulation upon the pronotum. First gastral tergite reticulate-punctate with longitudinal striae upon the basal third. Sparse pilosity is present upon the head and alitrunk.

Female. TL 5·0. As above but Emery (1899) states that the occipital corners of the head are acute and projecting. The clypeus is longitudinally striate but the remainder of the head is more or less reticulate-rugose, as is the pronotum. Mesoscutum and scutellum predominantly irregularly longitudinally rugose; propodeal spines short.

Any specimen from Madagascar combining a relatively very long and narrow head with the above series of characters should be recognizable as *tenuis*.

Cataulacus vorticus sp. n.

(Text-figs 16, 19)

Holotype worker. TL 3·5, HL 0·90, HW 0·82, CI 91, EL 0·42, OI 51, IOD 0·64, SL 0·44, SI 54, PW 0·56, AL 0·94, MTL 0·44.

Occiput and vertex meeting through a continuous convexity, occipital crest absent. Occipital corners with a bluntly triangular small tooth and with a denticle close to the tooth upon the occipital margin. Sides of head behind eyes shallowly convex, minutely and irregularly denticulate. Preocular tooth small, broadly triangular, separated from the eye by a smaller, rounded prominence. Pronotum weakly marginate laterally, the humeral angles acute and prominent, dentiform in dorsal view. A single tooth is present on the pronotal margin, close to the junction with the mesonotum. Between the humeral angles and this tooth the margin is smooth, very shallowly concave and without denticles. Sides of mesonotum scarcely or not marginate, without denticles; the propodeum similar and armed with a pair of spines. Dorsal surface of alitrunk without sutures or impressions; sides of alitrunk gradually convergent behind the pronotal tooth. In profile the anterior and posterior surfaces of the petiole strongly convergent dorsally, meeting in what is virtually a right-angle; the petiole without a differentiated dorsal face. Anterior face of postpetiole vertical, the posterior face almost so, the dorsal surface convex. Subpetiolar process simple, with a sharp posteroventral angle. Subpostpetiolar process simple, short, bluntly digitiform. First gastral tergite not marginate laterally.

Dorsum of head with a fine rugoreticulum everywhere, the interspaces finely and densely but shallowly reticulate-punctate, dully shining. Pronotal dorsum similarly but more densely sculptured, the reticulae close together and with a predominantly longitudinal trend. On the mesonotum and propodeal dorsum the rugae are fine and mostly longitudinal, more distinct upon the propodeum; the whole surface finely and quite strongly reticulate-punctate. Declivity of propodeum smooth and shining with scattered, very faint punctures. Petiole with some faint longitudinal rugulae; the postpetiole predominantly densely punctate but with a few faint rugules. First gastral tergite finely and densely reticulate-punctate.

Hairs on clypeus and remainder of the cephalic dorsum strongly clavate, the hairs longer and more distinct upon the clypeus than elsewhere. Dorsal surfaces of alitrunk, pedicel, appendages and gaster with numerous short, very fine, simple hairs, difficult to see on the alitrunk under low magnification.

Paratype workers. TL 3·4 – 3·5, HL 0·84 – 0·90, HW 0·74 – 0·82, CI 88 – 93, EL 0·38 – 0·44, OI 50 – 54, IOD 0·54 – 0·62, SL 0·40 – 0·44, SI 51 – 54, PW 0·52 – 0·56, AL 0·92 – 0·94, MTL 0·42 – 0·44 (3 measured).

As holotype but in the smallest the sides of the head behind the eyes lack denticles and the humeral angles are not as prominent. The subpetiolar process is clearly visible in one specimen and has the anteroventral angle broadly rounded.

Paratype females. TL 4·2 – 4·4, HL 1·00, HW 0·82 – 0·84, CI 82 – 84, EL 0·44 – 0·46, OI 53 – 55, IOD 0·62 – 0·66, SL 0·44, SI 52 – 54, PW 0·72 – 0·76, AL 1·22 – 1·26, MTL 0·44 – 0·46 (4 measured).

Similar to worker but with denticulation of sides of head behind eyes very much reduced or absent. Humeral angles as well developed as in worker but the tooth near the promesonotal junction absent. Propodeal spines short and blunt. Sculpturation of mesoscutum and propodeal dorsum longitudinal, that of the latter stronger than that of the former.

Paratype males. TL 3·8 – 4·0, HL 0·64 – 0·72, HW 0·64 – 0·72, CI 100 – 103, EL 0·28 – 0·34, OI 44 – 47, IOD 0·50 – 0·58, SL 0·28 – 0·30, SI 42 – 44, PW 0·64 – 0·68, AL 1·14 – 1·30, MTL 0·46 – 0·54 (4 measured).

Occipital crest absent; occipital corners acutely angled but not dentate. Sides of head behind eyes not denticulate. Humeral angles acute, dentiform in dorsal view, the remainder of the pronotal margins unarmed, shallowly concave and divergent posteriorly. Anterior arms of notauli strongly developed and cross-ribbed, the posterior arm a very weak impression or absent. Parapsidal furrows very strongly marked, impressed. Sides of remainder of alitrunk not

denticulate, the propodeum with a pair of short, acute teeth. Head predominantly rather coarsely reticulate-punctate, with some fine overlying rugulae. Pronotum, mesoscutum and scutellum reticulate-punctate with few or no rugulae. In one specimen the scutum has extensive smooth shiny patches surrounding the apical portions of the parapsidal furrows. Propodeal dorsum longitudinally rugose with reticulate-punctate interspaces; the petiole and usually the postpetiole similarly but much more finely sculptured; or the latter lacking distinct rugulae. First gastral tergite finely and densely reticulate-punctate or merely reticulate, dully shining. Hairs numerous on all dorsal surfaces, everywhere fine and simple.

Holotype worker, NIGERIA: Gambari, under bark of cocoa tree, 30.viii.1969 (*B. Bolton*) (BMNH).

Paratypes. 2 workers, 4 females, 3 males, same data as holotype (BMNH and MCZ, Boston). 1 worker, 1 male, ZAIRE: 91 miles W. of Popokabaka, 2.viii.1957 (*E. S. Ross* and *R. E. Leech*) (MCZ, Boston).

The nest from which the Nigerian specimens were taken was situated in and under the bark of a cocoa tree, at the junction of two main branches about 5 ft above ground level. The tree bark on and in the vicinity of the nest was covered with moss.

This species is closely related to *brevisetosus* and like that species it possesses clavate cephalic and clypeal hairs. It is separable by the armament of the pronotum which here consists of but a single tooth whilst in *brevisetosus* there is a row of denticles on each side.

Cataulacus weissi Santschi

Cataulacus weissi Santschi, 1913 : 310. Holotype worker, CONGO: Brazzaville, 1907 (*A. Weiss*) (NM, Basle) [examined].

Cataulacus traegaordhi var. *plectroniae* Wheeler, 1922*a* : 199. Syntype workers, ZAIRE: Stanleyville, from cavities of *Plectronia* sp. (*Lang & Chapin*) (MCZ, Boston). **Syn. n.**

Cataulacus jeanneli st. *kenyensis* Santschi, 1935 : 272, fig. 6a–c. Syntype workers, KENYA: Nairobi, st. 2, 1660 m, 1932–33 (*C. Arambourg, P. A. Chappuis & R. Jeannel*) (NM, Basle) [examined]. **Syn. n.**

Worker. TL 3·3 – 3·6, HL 0·82 – 0·96, HW 0·74 – 0·86, CI 89 – 95, EL 0·40 – 0·46, OI 51 – 54, IOD 0·58 – 0·64, SL 0·40 – 0·50, SI 51 – 58, PW 0·60 – 0·70, AL 0·90 – 1·00, MTL 0·44 – 0·48 (5 measured).

Occipital crest absent, the two surfaces meeting through a continuous convexity. Occipital corners with a small tooth and with a second such upon the occipital margin close to them. Sides of head behind eyes denticulate. Pronotum marginate laterally, serially denticulate; the margins of the mesonotum and propodeum also with one or more denticles. Propodeum with a pair of short, acute spines. Dorsal alitrunk without sutures. Subpetiolar process complex, the posteroventral angle drawn out into a long heel or spur. Subpostpetiolar process well developed, digitiform, almost as long as the subpetiolar process. First gastral tergite not marginate laterally. Dorsum of head and alitrunk with a fine loose rugoreticulum, the interspaces reticulate-punctate, more strongly so upon the alitrunk than upon the head. Petiole in dorsal view finely and regularly rugose, the rugae U- or V-shaped. First gastral tergite densely reticulate-punctate.

Simple stout, blunt hairs numerous everywhere, very conspicuous.

Female. TL 4·1, HL 0·94, HW 0·84, CI 90, EL 0·42, OI 50, IOD 0·64, SL 0·46, SI 55, PW 0·74, AL 1·20, MTL not measurable.

As worker but with the denticulation of the sides of the head behind the eyes reduced, and also that of the pronotal margins. Propodeal spines short and blunt. Subpetiolar process with the posteroventral angle not as strongly developed as in worker, but still prominent. Sculpturation similar to that of worker but the mesoscutum and scutellum distinctly and quite closely longitudinally rugose.

This small species, although of the *tenuis*-group, resembles *pygmaeus*, from which it is separated by the form of the subpetiolar process, the consistently larger ocular index and the form of sculpture upon the petiole.

As far as can be ascertained *weissi* is restricted to rather densely wooded or forested areas. The female and male were first described by Forel (1916 : 427) from the myrmecophilous plant *Randia myrmecophila* de Wilde, from Zaire. The description of the male is of no value and no specimens have been examined during the course of this study.

MATERIAL EXAMINED.

IVORY COAST: Banco Forest (*W. L. Brown Jr.*). GHANA: Bunso (*D. Leston*).

THE *INTRUDENS*-GROUP

Small to medium-sized species, TL usually more than 4·0, rarely slightly less, the measured range of TL 3·5 – 6·1, the lower measurements occurring only in *fricatidorsus* and small *pygmaeus* workers. Usually rather stoutly built forms with HW > 1·00, rarely less and never less than 0·90; PW > 0·80, very rarely slightly less. The head is most commonly broader than long, CI > 100; in two species CI straddles 100 but only in *pygmaeus* and *ebrardi* is it consistently less than 100. Eyes relatively small, OI < 50 in all cases, usually less than 46, with a measured range of OI 34 – 46.

Hairs always present on the dorsal surfaces of the head, body and appendages, usually conspicuous, short, stout and simple but in some species reduced in size, short and inconspicuous. Pronotum marginate laterally, the margins armed with a series of denticles or small teeth. Sides of pronotum usually somewhat convex in dorsal view and the alitrunk usually strongly narrowed behind the pronotum. Propodeal spines moderate in size, reduced to mere teeth in *mocquerysi*, often quite strongly dorsoventrally flattened and broad in dorsal view. Sculpturation is basically a rugoreticulum with reticulate-punctate interspaces, but this is reduced in some species.

Of the nine species included in this group two are restricted to the Malagasy region. Of the remainder the majority of species are savannah or veldt inhabiting and form the major part of the cataulacine fauna of southern and eastern Africa. One species, *pygmaeus*, seems equally able to survive in most areas but it shows a preference for savannah-like vegetation. The only rain forest inhabiting species of this group which has not been found outside such areas is *mocquerysi*, and it is interesting to note that this species is also structurally the most aberrant of the group, with a highly modified pedicellar structure.

Cataulacus bequaerti Forel

Cataulacus bequaerti Forel, 1913*c* : 316. Syntype workers, ZAIRE: Katanga, Kabanza (Kikondja), Riv. Lovoi, 21.x.1911 (*Bequaert*) (MHN, Geneva; MRAC, Tervuren; MNHU, Berlin) [examined].

Worker. TL 4·5 – 5·1, HL 1·20 – 1·30, HW 1·22 – 1·30, CI 100 – 102, EL 0·50 – 0·52, OI 40 – 41, IOD 1·00 – 1·04, SL 0·60 – 0·62, SI 47 – 49, PW 0·90 – 0·98, AL 1·26 – 1·40, MTL 0·66 – 0·70 (3 measured).

Occipital crest absent; occipital corners with a short, broadly rounded or a poorly developed, acute tooth and with a narrower but more acute tooth on the occipital margin close to the corners. Sides of head behind eyes crenulate or denticulate. Pronotum marginate laterally, the edges denticulate. Remainder of alitrunk denticulate laterally. Propodeum with a pair of broad, dorsoventrally flattened spines. Dorsal alitrunk without any trace of sutures. Subpetiolar process broad, the anteroventral corner extended into a broad, blunt spur, whilst the posteroventral corner forms an obtuse angle. Subpostpetiolar process simple, with a short, rounded, anteromedian prominence. First gastral tergite not marginate laterally.

Dorsal surfaces of head, alitrunk and gaster finely but very strongly and closely reticulate-punctate. The head and alitrunk also possess rugae, which on the head and pronotum form a reticulum, finer and closer upon the former than the latter. On the remainder of the alitrunk the cross-meshes tend to disappear and the rugae acquire a marked longitudinal trend. Apart from a few basigastric rugulae the first gastral tergite is entirely reticulate-punctate.

Stout, blunt, erect hairs numerous on all dorsal surfaces, abundant upon the head.

Of the species closely related to *intrudens*, *bequaerti* may immediately be separated by its marked abundance of short, stout hairs, especially evident upon the head capsule. The sculpturation is reasonably distinctive, the fine and dense but very strong reticulate-puncturation being immediately noticeable. In *intrudens* and other related species this sculpturation is never so emphasized, except on the mesonotum of some forms.

Bequaert (1922 : 370) records this species nesting in galls.

Cataulacus ebrardi Forel

Cataulacus ebrardi Forel, 1886 : 105. Syntype workers, MADAGASCAR: Moroudava (*M. Grandidier*) (MHN, Geneva) [examined].

Worker. TL 4·0 – 4·4, HL 1·00 – 1·08, HW 0·96 – 1·06, CI 96 – 98, EL 0·42 – 0·44, OI 41 – 44, IOD 0·78 – 0·86, SL 0·48 – 0·54, SI 50 – 51, PW 0·82 – 0·90, AL 1·12 – 1·20, MTL 0·50 – 0·56 (2 measured).

Occipital crest absent although the vertex is separated from the occipital surface by an obtuse angle. Occipital corners dentate and with a single tooth upon the occipital margin close to this on each side. Sides of head behind eyes denticulate. Sides of pro- and mesonotum marginate, sparsely denticulate; the mesonotal margins gradually convergent posteriorly but without a marked narrowing immediately behind the pronotum. Sides of propodeum with one or two blunt denticles; the spines quite narrow, short and acute. Dorsal alitrunk completely without sutures. Anteromedian subpostpetiolar process absent. First gastral tergite not marginate laterally.

Dorsum of head with a fine rugoreticulum with reticulate-punctate interspaces. Dorsal alitrunk similarly but much more loosely sculptured on the pronotum, rather more coarsely so upon the propodeum. Mesonotal disc without rugulae, only finely reticulate-punctate, although some fine rugulae may be present towards the lateral margins of the sclerite. Base of first gastral tergite with numerous longitudinal rugae which, however, fade out in the first quarter of the length of the segment and are replaced over the next half of its length by a fine, distinct reticulate-puncturation. This in its turn is replaced on the posterior quarter of the segment by a regular, close, longitudinal rugulation or sulcation.

Erect hairs present upon all dorsal surfaces but on the head and alitrunk they are very short and inconspicuous. On the alitrunk the hairs are longer on the propodeum than on the pronotum. Gastral hairs conspicuous.

The female of this species was described by Forel (1910*a* : 20) from the Amber Mountains of Madagascar but this specimen could not be located during the present study.

Cataulacus fricatidorsus Santschi **stat. n.**

Cataulacus otii st. *fricatidorsus* Santschi, 1914*a* : 26. Syntype workers, South Africa: Natal, Zululand, Dukudu, 27.vii.1905 (*I. Trägårdh*) (NM, Basle) [examined].

Worker. TL 3·5 – 3·8, HL 0·92 – 0·96, HW 0·98 – 1·04, CI 106 – 108, EL 0·40, OI 38 – 41, IOD 0·74 – 0·80, SL 0·48 – 0·50, SI 48 – 50, PW 0·82 – 0·86, AL 0·98 – 1·06, MTL ca 0·50 (2 measured).

Occipital crest absent, the vertex curving into the occiput through an obtuse angle. Occipital corners dentate and with a denticle on the occipital margin close to the corner tooth. Sides of head behind eyes denticulate; the preocular tooth usually reduced and rounded. Pronotum strongly marginate, the marginations expanded laterally so that they distinctly overhang the sides of the segment. Margination equipped with a number of irregular, rounded, tuberculiform denticles, some of which appear to be composed of two or more denticles fused together. Alitrunk strongly narrowed behind the pronotum. Mesonotum marginate but very weakly so, with one or two denticles. Propodeum with one or two lateral denticles and armed with a pair of short, acute spines. Dorsal alitrunk without any trace of sutures. Sides of first gastral tergite not marginate.

Dorsum of head finely reticulate-rugose with reticulate-punctate interspaces. Dorsal alitrunk similarly sculptured but the rugulation extremely fine except on the propodeum, where it is coarser than at any other place on the body. Dorsal surfaces of petiole and postpetiole longitudinally rugose. First gastral tergite strongly reticulate-punctate, without rugulae except at the base where a few longitudinal rugulae occur.

All dorsal surfaces of head and body with erect, stout, short hairs. In profile the hairs on the first gastral tergite are seen to be much denser basally and apically than in the centre of the sclerite.

Separable from *wissmanni* by details of structure and sculpturation, *fricatidorsus* may be distinguished from its immediate relatives by the form of margination and denticulation of the pronotum.

When an eye has been acquired for the species of this group it will be noted that in the present species the gaster tends to be proportionally shorter and broader than in related forms; also the tergite and sternite of the first segment tend to be strongly convex, giving the gaster a markedly short and stocky aspect.

Cataulacus intrudens (F. Smith)

(Text-fig. 26)

Meranoplus intrudens F. Smith, 1876 : 609, p. 11, figs 7, 7a. LECTOTYPE worker, South Africa: Natal, Durban, Weenen District, in acacia thorns (*J. M. Hutchinson*) (BMNH), here designated [examined]. (See note on types, below.)

Cataulacus intrudens (F. Smith) Mayr, 1886 : 364.

Cataulacus intrudens var. *rugosus* Forel, 1894 : 78. Syntype workers, MOZAMBIQUE: Delagoa, in gall, 2.xi.1890 (*Müller, Liengme*) (MHN, Geneva) [examined]. **Syn. n.**

Cataulacus hararicus Forel, 1894 : 79. Syntype workers, ETHIOPIA: southern region, Harar (*Ilg*) (MHN, Geneva) [examined]. **Syn. n.**

Cataulacus johannae Forel, 1895 : 250. Syntype workers, females, MADAGASCAR: eastern Imerina (*M. Sikora*) (MHN, Geneva) [examined]. **Syn. n.**

Cataulacus baumi Forel, 1901*b* : 304. Syntype workers, female, male, ANGOLA: Mossamedes, Cubango-Cuito (MHN, Geneva) [examined]. **Syn. n.**

Cataulacus baumi race *batonga* Forel, 1913*a* : 114. Syntype workers, RHODESIA: Khami River, 22.x.1911 (*G. Arnold*) (MHN, Geneva; MCZ, Boston) [examined]. **Syn. n.**

Cataulacus rugosus var. *subrugosus* Santschi, 1914*a* : 26. Syntype workers, SOUTH AFRICA: Natal, Zululand, junction of Umfolozi Rivers, 29.vi.1905 (*I. Trägårdh*) (NM, Basle) [examined]. **Syn. n.**

Cataulacus baumi race *batonga* var. *bulawayensis* Forel, 1915 : 218. Syntype workers, female, RHODESIA: Bulawayo, 31.v.1914 (*G. Arnold*) (MHN, Geneva) [examined]. [Name not available.]

Cataulacus intrudens st. *intermedius* Santschi, 1917 : 287. Syntype workers, RHODESIA: Bambesi, 25.vi.1914 (*G. Arnold*) (BMNH; NM, Basle) [examined]. **Syn. n.**

Cataulacus johannae race *densipunctatus* Stitz, 1923 : 163. Syntype workers, SOUTH WEST AFRICA (= Namibia): Tsumeb, 13–19.vi.1911 (*Michaelsen*) (location of types not known). **Syn. n.**

Cataulacus baumi st. *pseudotrema* Santschi, 1926 : 244. Syntype workers, TANZANIA: Duthumi, 18.ix.1919 (*A. Loveridge*) (NM, Basle) [examined]. **Syn. n.**

Cataulacus baumi var. *gazanus* Santschi, 1928 : 208. Syntype workers, MOZAMBIQUE: Beira, 6.vi.1920 (*G. Arnold*)(NM, Basle) [examined]. **Syn. n.**

Cataulacus baumi st. *pseudotrema* var. *tangana* Santschi, 1928 : 209. Syntype workers, female, TANZANIA: Tanga, 6.v.1925 (*G. Arnold*) (NM, Basle) [examined]. [Name not available.]

Cataulacus foveosquamosus Santschi, 1937*a* : 58, figs 8, 9. Holotype female, SOUTH AFRICA: Zululand (*I. Trägårdh*) (NM, Basle) [examined]. **Syn. n.**

Cataulacus umbilicatus Santschi, 1937*a* : 59 figs 10–12. Holotype female, MOZAMBIQUE: Beira, vii–viii.1936 (*M. Grobham*) (BMNH) [examined]. **Syn. n.**

Cataulacus rugosus var. *krugeri* Prins, 1965 : 104; pl. 1, figs 1–3; pl. 2, figs 1, 2. Holotype worker; paratype workers, females, males, SOUTH AFRICA: Pumbe 12.v.1962 (*Prins*) (National coll. Insects, Plant Protection Res. Inst., Pretoria). [Name not available.]

Note on *intrudens* types. During the search for the types of this species a single specimen (a male) was found at UM, Oxford which was marked 'type'. However, the date of collection upon the labels was 1879, proving that it was not of the type series as the species was described in 1876.

Amongst the numerous unnamed specimens of the F. Smith collection in the BMNH were five specimens of *intrudens* (3 workers, 2 males) each bearing only a single small data label, inscribed '76, 48. Natal'. This reference was checked against volume 4 of the British Museum Zoological Accessions (1864 1881), and on page 214, under '1876 no. 48' was the information: '*Meranoplus intrudens*. Natal. Presented by F. Smith. This species was found by Mr J. Monkhouse Hutchinson inhabiting thorns of a species of Acacia in the Weenen District, Natal.' This is exactly the information given by Smith in the original description of the species and it is concluded that these five specimens represent the type-series.

These have presently been designated lectotype (worker) and paralectotypes (2 workers, 2 males) and will be deposited in BMNH and MCZ, Boston. There is no trace of the female described by Smith, and this is presumed lost or destroyed.

Worker. TL 4·3 – 5·1, HL 1·04 – 1·48, HW 1·14 – 1·56, CI 103 – 110, EL 0·42 – 0·54, OI 34 – 40, IOD 0·86 – 1·16, SL 0·52 – 0·68, SI 43 – 47, PW 0·94 – 1·30, AL 1·16 – 1·62, MTL 0·54 – 0·82 (15 measured).

Occipital crest absent, vertex and occiput meeting through an angle, not normally confluent in a curved surface. Occipital corners dentate, with a second tooth or denticle internally upon the margin; often also with a few minute denticles on the angle separating vertex and occiput. Sides of head behind eyes usually denticulate, in a majority of cases noticeably so but sometimes the denticles minute, sometimes reducing in size from occipital corner to eye. Rarely denticles are completely absent. When this occurs the workers generally have a female head-shape. Shape of head very variable. On the one hand is a form which may be regarded as extreme worker-shape, and on the other as extreme female-shape, the latter approaching or the same as that found in most queens of this species. Numerous intermediate forms are known and on occasion both extreme forms may be found in the same nest, along with intermediates. The 'worker-shaped' head usually occurs in smaller individuals, more rarely in large, and is characterized by strong denticulation of the sides behind the eyes, strong anterior convergence of the frontal carinae and convexity of the sides of the head behind the eyes. The 'female-shaped' head always occurs in large individuals and shows reduced or absent denticulation of the sides behind the eyes (variable between workers from the same nest series), a reduced tendency for convergence of the frontal carinae anteriorly and a marked lack of convexity in the sides behind the eyes, so that in some individuals these are almost parallel. Alitrunk marginate laterally, denticulate, the denticles variable in size amongst workers, especially upon the pronotal margins. Propodeum with a pair of spines of variable configuration, but which are usually quite broad and somewhat flattened dorsoventrally. Dorsal alitrunk without sutures. Petiole in profile with a steeply sloping anterior face and a usually less steep posterior face, the latter sometimes shallowly concave. These two faces meeting in an acute angle dorsally and occasionally forming a weak ridge at their junction, the petiole without a developed dorsal surface. Postpetiole with a narrow, rounded dorsal surface separating the anterior and posterior faces. Subpetiolar process simple, usually with the antero- and posteroventral angles blunt, more rarely acute but never with the latter extended as a heel or spur. Subpostpetiolar process small and simple or virtually absent. First gastral tergite not marginate laterally.

Sculpturation extremely variable. The most common form of sculpturation consists of a dense rugoreticulum upon the head and pronotal dorsum with reticulate-punctate interspaces and usually with the reticular meshes shagreened. The rugulae usually tend to assume a more longitudinal direction upon the mesonotum and are often reduced or absent in the middle of this sclerite, being replaced wholly or in part by a fine, dense reticulate-puncturation. Propodeal dorsum usually quite strongly longitudinally rugose with few or no cross-meshes; these rugae noticeably more coarse than those upon the pro- or mesonotum. Propodeal declivity with transverse rugae between the spines. In some specimens the cross-meshes of the cephalic rugoreticulum are very reduced, so that the sculpturation is predominantly longitudinal. Variation from this common sculpturation usually occurs by reduction or intensification of one or more of the components. The most coarsely sculptured forms have the dorsal alitrunk and to a lesser extent the head covered with very coarse, strong, predominantly longitudinal rugae. The most weakly sculptured have the head shagreened with scattered foveolae, and the major portion of the dorsal alitrunk similarly sculptured. Traces of rugation are usually maintained on the propodeal dorsum. In large workers the cephalic sculpturation is often somewhat modified. Many of the rugulae are expanded and flattened, obliterating the smaller interspaces. This results in the appearance of coarse foveolae set in a shagreened surface. The pedicel segments usually show longitudinal rugae but some may be irregularly rugose. First gastral tergite varying from finely reticulate-punctate throughout to coarsely longitudinally rugose with reticulate-punctate interspaces.

Erect hairs present on all dorsal surfaces of head, body and appendages but very short and inconspicuous upon the clypeus and cephalic dorsum, and also on the pronotum, where they are usually reduced to very short, stout stubs or even stud-like vestiges.

Female. TL 6·2 – 7·4, HL 1·20 – 1·60, HW 1·24 – 1·66, CI 96 – 103, EL 0·46 – 0·60, OI 35 – 39, IOD 1·00 – 1·30, SL 0·60 – 0·76, SI 46 – 48, PW 1·20 – 1·50, AL 1·70 – 2·10, MTL 0·66 – 0·86 (5 measured).

Head shape as described above for large female-like workers, very rarely shaped similarly to the typical head form of smaller workers. Denticulation of the sides of the head behind the eyes reduced or absent, as is the denticulation of the alitrunk margins. Propodeal spines reduced, proportionately broader and shorter than in the worker. Sculptural variation as described above.

Male. TL 5·3 – 5·7, HL 1·12 – 1·20, HW 1·22 – 1·28, CI 106 – 109, EL 0·44, OI 34 – 36, IOD 0·94 – 0·96, SL 0·54 – 0·56, SI 43 – 44, PW 1·06 – 1·08, AL 1·74 – 1·82, MTL 0·68 – 072 (3 measured).

Head shape similar to small worker, the sides of the head behind the eyes dentate. Pronotum marginate laterally but not denticulate, similarly with the propodeal margins. Propodeal spines short, blunt and very stout. Parapsidal furrows distinct, the notauli acutely V-shaped rather than Y-shaped, with the posterior portion distinct to the margin of the scutellum. Dorsum of head finely and very densely reticulate-rugose, the longitudinal constituents predominating and more emphasized than the transverse; the interspaces reticulate-punctate. Pronotum similarly but more loosely sculptured, the mesoscutum with only a few weak rugulae, predominantly reticulate-punctate. Scutellum and propodeal dorsum with a rather coarse rugoreticulum. Pedicel longitudinally rugose, gaster finely and densely reticulate-punctate. All dorsal surfaces of head, body and appendages with numerous hairs.

The tremendous variation of this species accounts for much of the synonymy quoted above. The majority of these forms were described from variations in head shape or sculpturation, some from even more minor details such as differences in propodeal spine length or in pronotal denticulation. Large workers with female-shaped heads and foveolate sculpturation were responsible for *baumi* and its subspecies and varieties whilst variation in size and sculpturation account for *rugosus* and *johannae* with coarse sculpture on the one hand, and *subrugosus* and *intermedius* with finer sculpture on the other. Many of the forms were stated in their original descriptions to be close to *intrudens* or stated as links between two or more forms. For example, both *intermedius* and *subrugosus* were given as intermediates between *rugosus* and *intrudens*. As this species is the most common of the genus in southern and eastern Africa it is probably the one which Arnold (1917) had in mind when he wrote that, 'many of the so-called species and races are very closely allied, so much so that I believe a study based on more abundant material will later on serve to reduce the present number of species to a much smaller figure'. In fact, when part 4 of his monograph of South African ants was published, Arnold (1920 : 403) went so far as to state that there were probably only the nuclei of two species in the area, one of which included *baumi, batonga, bulawayensis* and *intermedius*. This observation is now known to be accurate. Santschi (1937*a*) described the female of the species twice, from two separate localities, basing his descriptions to a large extent upon the very characters which had proved so misleading in the past.

The same mistake was made by Prins who, as late as 1965 described a variety *krugeri*, differentiating it from *rugosus* by its, 'slightly longer and more acute epinotal spines and by the sculpture of the abdomen which is less developed'. These are the trifling and intrinsically variable characters so much used by earlier authors and which are responsible for the great proliferation of valueless names in the more variable species of this genus.

C. intrudens nests in twigs and branches of trees and shrubs. Arnold (1917 : 391) records it from hollow twigs of an acacia whilst Prins (1965 : 104) found it nesting in a branch of a red bush-willow, *Combretum apiculatum* Sond.

MATERIAL EXAMINED.

SOMALIA: Duca Abruzzi (*Finzi* coll.). KENYA: near Witu (*A. Loveridge*); Neumann's Boma (*Allen* and *Brooks*); Diani Beach (*F. X. Williams*); Kwale Forest (*M. Steele*); Diani Beach (*N. L. H. Krauss*). TANZANIA: no loc. (*A. Loveridge*); Pangani (*N. L. H. Krauss*). ZAMBIA: Upper Luangwa River (*S. A. Neave*). MALAWI: Mlanje (*S. A. Neave*); between Ft. Mangoche and Chikala Boma (*S. A. Neave*). RHODESIA: Lonely Mine (*H. Swale*), Bulawayo (*G. Arnold*); Bulawayo (*H. Swale*); Marandellus (*G. H. Bunzli*); Victoria Falls (*G. Arnold*); Victoria Falls (*W. L. Brown jr.*); Plumtree (*G. Arnold*); Sawmills (*G. Arnold*); Bembesi (*G. Arnold*); Matopos (*G. Arnold*); Helenvale (*G. Arnold*). MOZAMBIQUE: Lourenco Marques (*H. Junod*); Delagoa (*Wheeler* coll.) Delagoa (*Staudinger*); Delagoa Bay (*R. E. Turner*). ANGOLA: Mossamedes (*Arnold* coll.). SOUTH WEST AFRICA: Aus (*R. E. Turner*); Maud (*Vernay & Lang*); Kabulabula (*H. Laing*); Narrugas (*G. Arnold*); Nkate (*Vernay & Lang*); Tsotsorogo (*G. U. Son*). SOUTH AFRICA: Transvaal (*Lingnau*); Natal, Slievyre (*Haviland*); Pretoria (*A. L. Carpenter*). MADAGASCAR: no loc. (*Staudinger*).

Cataulacus micans Mayr

Cataulacus rugosus subsp. *micans* Mayr, 1901 : 27. Syntype workers, females, males, SOUTH AFRICA: Port Elizabeth, 1890 (*Brauns*) (NM, Vienna) [examined].

Cataulacus micans Mayr; Forel, 1915 : 219 [raised to species].

Cataulacus intrudens st. *tristiculus* Santschi, 1919*a* : 237. Syntype workers, female, male, SOUTH AFRICA: Cape Province, Port Elizabeth, 1917 (*T. Reese*) (NM, Basle) [examined]. **Syn. n.**

Worker. TL 4·2 – 4·7, HL 1·02 – 1·18, HW 1·04 – 1·12, CI 100 – 102, EL 0·42 – 0·44, OI 39 – 40, IOD 0·80 – 0·86, SL 0·54 – 0·56, SI 49 – 50, PW 0·82 – 0·92, AL 1·12 – 1·22, MTL 0·52 – 0·56 (3 measured).

Occipital crest not developed but the vertex separated from the occiput by an acute angle. Occipital corner dentate, the tooth flanked by a smaller denticle on the occipital margin. Sides of head behind eyes denticulate. Pronotum marginate, the edges weakly denticulate, the denticles not strongly developed, usually appearing as rather low, broadly triangular prominences. Sides of mesonotum and propodeum each with one or two denticles, the latter armed with a pair of spines. Mesokatepisternal tooth relatively very strongly developed, long, triangular and acute, projecting anterolaterally and visible with the alitrunk in dorsal view. Dorsal alitrunk without trace of sutures. First gastral tergite not marginate laterally.

Dorsum of head rather coarsely and closely longitudinally rugose; this sculpturation being derived from a rugoreticulum of which some cross-meshes are visible, though much less strongly developed than the longitudinal component. Interspaces superficially reticulate-punctate, somewhat shining. Sculpturation of dorsal alitrunk variable in intensity but basically of a fine, loose rugoreticulum on the pronotum, the cross-meshes of which tend to be lost on the mesonotum, resulting in a fine, longitudinal rugulation upon that segment. Interspaces everywhere finely and densely reticulate-punctate. Segments of pedical coarsely longitudinally rugose. First gastral tergite very finely sculptured, either with a fine superficial reticulation or reticulate-puncturation and usually with a few faint basigastric rugulae.

All dorsal surfaces of head and body with erect, stout, blunt hairs; those on the head may be very short and inconspicuous.

Female. TL 5·5, HL 1·22, HW 1·20, CI 99, EL 0·48, OI 43, IOD 0·88, SL 0·58, SI 48, PW 1·04, AL 1·54, MTL 0·66.

As worker, with the usual modifications of the alitrunk. Denticles of sides of head behind eyes reduced, the appearance crenulate. Pronotal margination irregular, with only two or three developed denticles. Mesokatepisternal tooth short and blunt. Propodeal spines short and blunt. Sculpturation of head and pronotum as worker, the mesoscutum sparsely longitudinally rugose, the mesoscutellum rather more coarsely rugose. Propodeal dorsum transversely rugose.

Male. TL 4·6, HL 0·90, HW 0·96, CI 106, EL 0·38, OI 40, IOD 0·72, SL 0·50, SI 52, PW 0·84, AL 1·40, MTL 0·58.

Vertex rounding into occiput, the two surfaces not separated by an angle. Occipital corners dentate, sides of head behind eyes denticulate. Sides of pronotum weakly marginate, with one or two tuberculiform denticles. Anterior arms of notauli developed and crossribbed but tending to fade out medially, the posterior arm absent. In dorsal view the shape of the anterior arms tends to be broadly U-shaped rather than V-shaped. Propodeal spines short and blunt. Sculpturation of head as in worker but the longitudinal rugae fine and relatively widely separated. Alitrunk sculptured as female but on the propodeum the rugae diverge posteriorly towards the bases of the spines. Between the spines the rugae are transverse. Erect hairs present on all dorsal surfaces.

The worker is characterized by its very strongly developed mesokatepisternal tooth and the wealky sculptured, often polished gaster.

In the original description Mayr showed how this form differed from *rugosus* (now a synonym of *intrudens*) and from *intrudens* itself. Forel (1915) indicated that *micans* was best treated as a good species and this view is endorsed by the present author.

Cataulacus mocquerysi E. André

(Text-fig. 24)

Cataulacus mocquerysi E. André, 1889 : 229. Holotype worker, Sierra Leone (MNHN, Paris) [examined].

Cataulacus mocquerysi var. *nainei* Forel, 1917*b* : 724. Holotype worker, Zaire (*H. Kohl*) (MHN, Geneva) [examined]. **Syn. n.**

Worker. TL 4·0 – 5·5, HL 1·00 – 1·40, HW 1·12 – 1·54, CI 110 – 115, EL 0·46 – 0·56, OI 35 – 41, IOD 0·94 – 1·24, SL 0·60 – 0·72, SI 46 – 53, PW 1·02 – 1·48, AL 1·02 – 1·44, MTL 0·56 – 0·60 (10 measured).

Occipital crest absent, the vertex rounding into the occiput. Occipital corners with one or two small teeth or denticles, the sides of the head behind the eyes denticulate in most but only crenulate in some individuals. Pronotum marginate laterally, the margins with a few rather large denticles and terminating posterolaterally in a flattened and strongly expanded, roughly triangular shaped lobe which bears one or two denticles upon its posterior border. Mesonotum with one or two large denticles laterally. Propodeal spines reduced to a pair of very short teeth or to a pair of denticles which may be shorter than those upon the mesonotum, and which are usually blunt apically. Petiole and postpetiole strongly flattened dorsoventrally, without differentiated nodes. In dorsal view both segments are very broadly and stoutly V-shaped, the postpetiole more distinctly so than the petiole. Subpetiolar process with a distinct posteroventral heel or spur. First gastral tergite not marginate.

Sculpturation of head and dorsal alitrunk of a fine, loose rugoreticulum with reticulate-punctate interspaces. In some individuals the rugulae tend to assume a longitudinal direction, especially upon the head. Dorsum of petiole similarly sculptured or merely reticulate-punctate; the most common form has numerous fine longitudinal rugulae. Postpetiole more coarsely sculptured, usually with coarse rugae directed longitudinally. First gastral tergite finely and densely reticulate-punctate.

Stout, erect hairs present upon all dorsal surfaces of the head, body and appendages.

Female. TL 6·8, HL 1·54, HW 1·56, CI 101, EL 0·56, OI 36, IOD 1·22, SL 0·76, SI 48, PW 1·44, AL 1·94, MTL 0·86.

Similar to worker but the rugose part of the sculpturation tending to be more coarse everywhere, and the denticulation of the sides of the head and pronotum to be reduced. Propodeum with a pair of bluntly rounded angles.

The species is characterized by, and is immediately recognizable because of the unique form of the pedicel segments and the great reduction or virtual loss of the propodeal spines.

This small and relatively uncommon species nests in hollow twigs on bushes and trees. A nest examined at the Cocoa Research Institute of Ghana during August 1970 had been made in a dry, hollow twig on a shrub, and was about 3 inches long by 0·25 inch wide. This contained a queen and seven rather small workers along with a number of brood. The workers wander over the bark and leaves of the tree in which the nest is situated but their feeding habits have not been observed.

MATERIAL EXAMINED.

LIBERIA: Cape Mount (*W. M. Mann*); Bendija (*W. M. Mann*); Reputa (*W. M. Mann*); Harbel (*W. M. Mann*). GHANA: Tafo (*B. Bolton*); Bunso (*D. Leston*). NIGERIA: Ibadan (*R. H. Booker*); Gambari (*B. Bolton*). ZAIRE: 50 km south of Tshela (*E. S. Ross & R. E. Leech*).

Cataulacus pygmaeus E. André

(Text-fig. 25)

Cataulacus pygmaeus E. André, 1890 : 325. Holotype worker, SIERRA LEONE (*A. Mocquerys*) (MNHN, Paris) [examined].

Cataulacus pygmaeus var. *chariensis* Santschi, 1910*b* : 358. Holotype worker, CHAD: Moyen Chari, Fort Archambault (*J. Decorse*) (MNHN, Paris) [examined]. **Syn. n.**

Cataulacus pygmaeus var. *bakusuensis* Forel, 1913*b* : 350. Syntype female, male, ZAIRE: Bakusu, dans un rameau (MRAC, Tervuren) [examined]. **Syn. n.**

Cataulacus traegaordhi Santschi, 1914*a* : 24, fig. 3. Syntype workers, male, female, SOUTH AFRICA: Natal, Zululand, Dukudu, 27.vii.1905 (*I. Trägårdh*) (NM, Basle; MRAC, Tervuren) [examined]. **Syn. n.**

Cataulacus trägårdhi [sic] var. *ugandensis* Santschi, 1914*b* : 110. Syntype workers, UGANDA: Unyoro Prov., near Hoima, i.1909 (*Ch. Alluaud*) (NM, Basle) [examined]. **Syn. n.**

?*Cataulacus marleyi* Forel, 1915 : 219. Syntype workers, SOUTH AFRICA: Natal, Krants Kloof (*H. B. Marley*) (location of types not known). (Provisional synonym, see below.)

Cataulacus jeanneli var. *aethiops* Santschi, 1924 : 220. Syntype workers, ZAIRE: Kidada-Kitobola, 14/25.ii.1922 (*H. Schouteden*), and Barumbu (*Bequaert*) (MRAC, Tervuren) [examined]. **Syn. n.**

Cataulacus pygmaeus subsp. *suddensis* Weber, 1943 : 378. Syntype workers, male, SUDAN: Upper White Nile, Adok, in the Sudd, 10.vii.1939 (*N. A. Weber*) (probably in AMNH, New York). **Syn. n.**

Worker. TL 3·7 – 4·4, HL 0·94 – 1·10, HW 0·92 – 1·06, CI 94 – 97, EL 0·40 – 0·46, OI 41 – 46, IOD 0·72 – 0·84, SL 0·48 – 0·52. SI 49 – 51, PW 0·72 – 0·90. AL 1·01 – 1·26, MTL 0·48 – 0·56 (15 measured).

Occipital crest absent, the vertex rounding into the occiput. In some specimens the sculpturation of the dorsum of the head terminates quite suddenly behind, giving the appearance of a slight crest. Occipital corners denticulate and with a second denticle close to the corner on the occipital margin; these two denticles small, usually no larger than others upon the body. Sides of head behind eyes denticulate. Sides of pronotum strongly marginate, denticulate, the alitrunk sharply narrowed immediately behind the pronotum, the mesonotum notably less broad. Sides of alitrunk behind the pronotum more weakly marginate, denticulate. Propodeum armed with a pair of broad, dorsoventrally flattened spines. Dorsal alitrunk without sutures. Subpetiolar process variable, either with rounded angles or with the postero-ventral angle acute and sometimes prominent. Subpostpetiolar process rather short, simple but distinct. First gastral tergite not marginate laterally.

Dorsum of head with a fine loose rugoreticulum, rarely with the longitudinal component predominating. Interspaces finely, densely and rather faintly reticulate-punctate, the surface somewhat shining. Pronotal dorsum with a rugoreticulum, coarser than that of the head, the meshes widely spaced, the interspaces reticulate-punctate and dully shining. On the mesonotum and propodeal dorsum there is a tendency for the cross-meshes of the reticulum to disappear, leaving a fine, widely spaced and irregular longitudinal rugation. First gastral tergite densely reticulate-punctate, with fine rugulae everywhere upon the disc of the sclerite, predominantly or wholly longitudinal in direction.

Dorsal surfaces of head, body and appendages with numerous short, stout, simple hairs. Rarely these hairs are increased in thickness from base to apex upon the cephalic dorsum.

Female. TL 5·2 – 5·3, HL 1·14 – 1·16, HW 1·08, CI 92 – 95, EL 0·44 – 0·50, OI 40 – 46, IOD 0·80 – 0·84, SL 0·52 – 0·54, SI 48 – 50, PW 0·96 – 0·98, AL 1·48 – 1·50, MTL ca 0·62 (3 measured).

As worker, with the usual modification of the alitrunk for flight. Denticulation of the sides of the head behind the eyes and often of the pronotal margins reduced, sometimes absent from the former. Mesoscutum with marked longitudinal rugation, with few or no cross-meshes.

Male. TL 4·2 – 4·3, HL 0·84 – 0·86, HW 0·90 – 0·92, CI 105 – 109, EL 0·38, OI 41 – 42, IOD 0·66 – 0·72, SL ca 0·44, SI 47 – 49, PW 0·74 – 0·78, AL 1·34 – 1·36, MTL ca 0·58 (2 measured).

Occipital crest absent, occipital corners denticulate and with a second denticle on the occipital margin close to the corners. Sides of head behind eyes denticulate. Preocular tooth reduced to a mere angle or absent. Pronotal margins irregular but not denticulate. Anterior arms of notauli well developed and cross-ribbed, the posterior arm absent or its track marked by a faint impression. Propodeal spines reduced to a pair of acute teeth. Dorsum of head predominantly reticulate-punctate with a few very fine longitudinal rugulae and a weak reticulum close to and behind the eyes. Pronotum similarly sculptured but with a very loose rugoreticulum everywhere, the meshes widely spaced. Mesoscutum quite strongly reticulate-punctate with a few longitudinal rugulae. Propodeal dorsum reticulate-rugose, the rugae here stronger than anywhere else upon the dorsal alitrunk or head. First gastral tergite finely reticulate or superficially reticulate-punctate, shining. Simple erect hairs present on all dorsal surfaces of the head and body.

As mentioned under *brevisetosus* it is possible that individuals of *pygmaeus* which have the cephalic hairs gradually increased in thickness from base to apex may be confused with the former species. Notes on the separation of such forms from true *brevisetosus* are given under that species.

C. pygmaeus is separated from species closely related to *brevisetosus* by its relatively small eyes (OI < 50) and loose, very fine reticulate-rugose sculpturation upon the head and alitrunk, in which the meshes are widely separated.

With one exception, all the synonyms stated above are quite straightforward, involving relatively minor variations in sculpturation and structure. The exception is *marleyi*, which is stated as a provisional synonym. The reason for this procedure is that I have not been able to locate the types of this species, and whilst the original description does not separate it from *pygmaeus* or *traegaordhi* it is very superficial. When the types of *marleyi* are found some characters may be present which will separate it from *pygmaeus* or may on the other hand confirm the synonymy. From the evidence as it stands at the moment I believe that *marleyi* will be found to be a synonym, and more or less identical to *traegaordhi*, a name published in the same year describing an obviously similar form from the same area of South Africa.

Although *pygmaeus* is very widespread in Africa its distribution seems mostly confined to savannah regions or open wooded areas, but it is also known from forests. Nests are made in stems or twigs of low shrubs or trees and the workers forage freely upon the plant. Small coccids are tended on the apical portions of twigs or flower stalks.

MATERIAL EXAMINED.

LIBERIA: Harbel (*W. M. Mann*). IVORY COAST: near Abidjan (*W. L. Brown jr.*). GHANA: Accra (*O. W. Richards*); Larteh (*D. Leston*); Pokoase (*N. L. H. Krauss*); Koforidua (*N. L. H. Krauss*). ZAIRE: Banana (*Bequaert*); Congo da Lemba (*R. Mayné*); Kasai, Dubbi (*H. Schouteden*); Mongende (*H. Schouteden*); Kasai, Ngombe (*H. Schouteden*); Baraka (*R. Mayné*); Kwamouth (*H. Schouteden*); Kasai, Belenge (*H. Schouteden*); Basongo (*H. Schouteden*); Benza Mazola (*R. Mayné*); Bolobo (*H. Schouteden*); Lukala (*H. Schouteden*); Luebo, Kamaiebi (*H. Schouteden*); Haut Uele (*L. Burgeon*); Mayumbe, Kiniati (*R. Mayné*); Nyangwe (*R. Mayné*); Kunzulu (*R. Mayné*); Temvo (*H. Schouteden*); Kunungu (*H. Schouteden*); Kilo (Abetti); Stanleyville (*L. Burgeon*); Kitobola, Kidada (*H. Schouteden*); Katanga, Biano (*A. Mackie*). TANZANIA: Kigoma (*R. Mayné*). KENYA: Mgombe (*A. Loveridge*).

Cataulacus voeltzkowi Forel

Cataulacus voeltzkowi Forel, 1907 : 84. Syntype workers, MADAGASCAR: Grand Comoro Is., Moheli (*Voeltzkow*) (MHN, Geneva; MNHU, Berlin) [examined].

Worker. TL 4·5 – 5·2, HL 1·14 – 1·36, HW 1·20 – 1·32, CI 97 – 105, EL 0·42 – 0·50, OI 34 – 38, IOD 0·88 – 1·00, SL 0·56 – 0·66, SI 46 – 50, PW 0·92 – 1·06, AL 1·28 – 1·48, MTL 0·64 – 0·72 (6 measured).

Occipital crest not developed but vertex and occiput separated by an angle. Occipital corners with a small tooth and also with a smaller tooth flanking them upon the occipital margin; the latter usually bears a few very small denticles. Sides of head behind eyes denticulate. Pronotum marginate, equipped with a series of small denticles, or less commonly the margin with a serrate appearance. Mesonotum and propodeum each with one or two denticles laterally, the propodeum armed with a pair of flattened spines. First gastral tergite not marginate laterally.

Dorsal surfaces of head and alitrunk coarsely and closely reticulate-rugose, with a predominantly longitudinal direction upon the head, mesonotum and propodeum. On the pronotum however the reticulum is more complete and is not directional. The relatively small interspaces between the rugae are finely reticulate-punctate. Gastral rugae very regular and evenly spaced. In dorsal view all rugae originate at the base of the first tergite and initially run longitudinally. Those on the disc, however, terminate in the anterior one-third to one-half of the length of the segment. The laterally situated rugae then curve strongly around the apices of the discal rugae and run transversely across the remainder of the disc. The result is that if a median longitudinal strip of the tergite is examined the rugae thereon run longitudinally in the anterior portion and transversely in the posterior portion. Short, erect hairs are present upon all dorsal surfaces of the head and body, which may be inconspicuous upon the pronotum and mesonotum.

Amongst the species immediately related to *intrudens*, *voeltzkowi* is certainly the easiest to recognize. The unique form of the gastral sculpturation is unmistakable.

Cataulacus wissmanni Forel

(Text-fig. 27)

Cataulacus wissmanni Forel, 1894 : 78. Holotype worker, MOZAMBIQUE: 9.xi.1890 (*A. Muller*) (MHN, Geneva) [examined].

Cataulacus wissmanni race *otii* Forel, 1901*b* : 304. Syntype workers, female, SOUTH AFRICA: Natal, Durban (*Haviland*) (MHN, Geneva) [examined]. **Syn. n.**

Cataulacus wissmanni st. *linearis* Santschi, 1914*b* : 109, fig. 17. Syntype workers, KENYA: Voi, in the Wa-Taita (st. no. 60), 600 m, and Mbuyuni, in Pori (st. no. 63), iii. 1912 (*Alluaud & Jeannel*) (NM, Basle) [examined]. **Syn. n.**

Cataulacus micans race *durbanensis* Forel, 1915 : 219. Holotype worker, SOUTH AFRICA: Natal, Durban, 15.i.1914 (*G. Arnold*) (MHN, Geneva) [examined]. **Syn. n.**

Worker. TL 3·8 – 5·2, HL 0·96 – 1·20, HW 0·96 – 1·20, CI 98 – 104, EL 0·44 – 0·50, OI 41 – 45, IOD 0·74 – 0·90, SL 0·48 – 0·60, SI 50 – 53, PW 0·78 – 1·02, AL 1·06 – 1·50, MTL 0·56 – 0·66 (10 measured).

Occipital crest absent, the two surfaces meeting in an obtuse angle. Occipital corners dentate, with a second short tooth internal to them upon the occipital margin. Sides of head behind eyes strongly convex and denticulate. Sides of pronotum marginate and denticulate, similarly the margins of both the mesonotum and propodeum with denticles. Propodeum bispinose. Mesokatepisternal tooth variously developed; in most individuals large and conspicuous but variable in size even in series from a single nest. Subpetiolar process simple, often without a differentiated posteroventral angle. Subpostpetiolar process weakly developed or virtually absent. First gastral tergite not marginate laterally.

Dorsum of head reticulate-rugose, the rugae usually emphasised in a longitudinal direction, with the interspaces weakly reticulate-punctate. Dorsal alitrunk usually similarly but more finely sculptured except for the propodeum where the longitudinal rugae are more strongly developed. Middle of disc of mesonotum often with the reticulation diminished and the reticulate-punctate sculpturation clearly visible. Petiole and postpetiole longitudinally rugose. First gastral tergite very strongly and often coarsely longitudinally rugose, occasionally throughout its length but more usually with the rugae broken in the middle of the disc and replaced by a fine reticulate-puncturation. All dorsal surfaces with numerous, very conspicuous, relatively long, simple hairs.

Female. TL 5·4 – 6·0, HL 1·14 – 1·22, HW 1·10 – 1·22, CI 97 – 100, EL 0·48 – 0·50, OI 41 – 43, IOD 0·84 – 0·90, SL 0·54 – 0·62, SI 49 – 51, PW 1·02 – 1·10, AL 1·50 – 1·76, MTL 0·62 – 0·72 (2 measured).

As worker but with the denticulation of the sides of the head behind the eyes and the margins of the alitrunk reduced, on the latter to very small, triangular prominences. Propodeal spines short, blunt.

This species may be confused with *ebrardi*, which is certainly closely related. Besides distribution, one of the best separating characters lies in the relative lengths of the alitrunk hairs. In *ebrardi* they are short and inconspicuous whilst in *wissmanni* they are very distinct. Also, in the former species the longitudinal rugation occupies only the anterior and posterior quarters of the length of the first gastral tergite, the intervening space being reticulate-punctate; whilst in *wissmanni* the punctuation on the tergite is usually limited to a patch in the middle of the disc.

MATERIAL EXAMINED.

MOZAMBIQUE: Delagoa Bay (*F. Muir*); Delagoa Bay (*R. E. Turner*). SOUTH AFRICA: Natal, Durban (*G. Arnold*); Natal, Durban (*F. W. B Marley*); Durban (Muir); Durban (*C. B. Cooper*); Durban (*Haviland*).

THE *GUINEENSIS*-GROUP

Medium to large-sized species, TL 4·5 – 9·5, with the head always broader than long, often considerably so, CI 101 – 121, and with relatively small to medium eyes, OI < 45 (measured range of OI 26 – 43).

Simple stout hairs numerous upon all dorsal surfaces of the head, body and appendages except in some individuals of *guineensis* where they may be reduced in number. Pronotum marginate laterally, often strongly so, the margins armed with a series of small teeth or denticles. Besides this the posterolateral portion of the pronotal margination is expanded, usually strongly so, and projects as a spine, tooth or plate. Propodeal spines long, stout and acute, not dorsoventrally flattened.

The three species included in this small group inhabit the rain forests of West and Central Africa, and *guineensis* is probably the most common species of the genus in such areas.

Cataulacus erinaceus Stitz

(Text fig. 21)

Cataulacus erinaceus Stitz, 1910 : 134, fig. 3. Syntype workers, CAMEROUN: Mundame (*Conradt*); and EQUATORIAL GUINEA: Alen (*Tessmann*) (MNHU, Berlin) [examined].

Cataulacus princeps 'Emery'; Forel, 1909*a* : 71. Nomen nudum.

Cataulacus erinaceus var. *crassispina* Santschi, 1917 : 287. Holotype worker, CONGO REPUBLIC: Goda, P. Charleuf (*H. de Buysson*) (NM, Basle) [examined]. **Syn. n.**

Worker. TL 8·1 – 9·5, HL 1·90 – 2·34, HW 2·22 – 2·70, CI 115 – 117, EL 0·62 – 0·74, OI 27 – 29, IOD 1·74 – 2·06, SL 1·16 – 1·38, SI 51 – 53, PW 1·90 – 2·40, AL 2·20 – 2·68, MTL 1·40 – 1·62 (10 measured).

Occipital crest absent, the vertex rounding into the occiput. Occipital corners armed with a large, triangular, broad tooth, the sides of the head behind the eyes strongly denticulate. Preocular tooth relatively small, in some cases indistinct. Pronotum marginate laterally, strongly denticulate; the margination expanded, much broader behind than in front and

posterolaterally produced into a long, very broadly triangular spine, the edges of which are denticulate. Sides of mesonotum and propodeum weakly marginate, at least in part, the latter with denticles, the former with at least one denticle. Propodeum with a pair of long, acute, tapering spines which are quite broad basally. In profile both the propodeal spines and the posterolateral pronotal spines are seen to be directed somewhat upwards. The angle of elevation of both pairs of spines tends to vary, and in some specimens the propodeal spines may be directed almost vertically. Sutures absent from dorsal alitrunk but the region of the metanotal groove somewhat impressed, shallowly concave in profile, with the promesonotum on a somewhat higher level than the propodeal dorsum. Petiole and postpetiole nodose, the former more massive than the latter. First gastral tergite not marginate laterally.

Sculpturation of entirety of dorsum of head, alitrunk and pedicel of a coarse rugoreticulum with very finely and densely reticulate-punctate interspaces. First gastral tergite similarly sculptured but the rugoreticulum much finer and more dense.

Short, blunt, stout, erect hairs numerous everywhere, arising from the points of junction of the meshes of the rugoreticulum. This is particularly conspicuous upon the pronotal dorsum.

This species is very easily recognizable due to its large size and distinctive sculpturation. The form and denticulation of the alitrunk also help to separate *erinaceus* from the closely related *guineensis*. Forel (1916 : 427) described the female of this species, which does not differ markedly from the worker. The male remains unknown, as in the majority of African species of *Cataulacus*.

The variety *crassispina* was founded upon a specimen with rather reddish pilosity, shorter propodeal spines which were rather more elevated than usual, and a shorter pedicel. These characters fall well within the limits of variation established in the present survey. Wheeler (1922*a* : 198) noted under *erinaceus* that, 'Forel many years ago gave me a specimen labelled "*Cataulacus princeps* Emery" and has himself referred to it under that name [teste Forel, 1909*a*] which seems to exist only in manuscript'. A specimen loaned by MCZ, Boston, examined during the present survey bears the label '*C. princeps* Emery'. This specimen, as the one referred to by Wheeler, is a very ordinary individual of *erinaceus*, and as no description of *princeps* exists it is here included as a nomen nudum.

In the same publication Wheeler notes that *erinaceus* was found in Zaire running up and down large trees. C. A. Collingwood collected the species from trees in the primary forest reserve of Mount Atewa, Ghana, and the present author has observed individuals in the same locality running upon the moss-covered trunks of living trees and also crawling along the tendrils of a thorny creeper in a clearing. The specimens from Du River, noted below, were taken from a nest 'under moss in the bark of a big tree, 20 ft above ground'.

MATERIAL EXAMINED.

LIBERIA: Degain (*W. M. Mann*); Belleyella (*W. M. Mann*); Du River, camp no. 3 (?). GHANA: Mt. Atewa (*C. A. Collingwood*); Mt. Atewa (*D. Leston*). CAMEROUN: Meyo (*C. A. Collingwood*). ZAIRE: Stanleyville (*H. O. Lang*); Stanleyville (*Forel* coll.); Irangi, Luhoho River (*E. S. Ross & R. E. Leech*); Stanleyville Nyangwe (*Fuacomet*); Kasai, Kondue (*E. Luja*); Miss. St. Gabriel (*Kohl*); Eala (*P. Staner*); Bas Uele, Kotell (*H. Schouteden*); Ituri, Masua (*A. Collart*); Likimi, Mundjungani (*A. Collart*); Kwawa, Bangala (*A. Collart*); Barumbu (*Bequaert*);

Penghe (*Bequaert*); Basongo (*H. Schouteden*); Luebo, Kamaiembi (*H. Schouteden*); Stanleyville (*L. Burgeon*); Kunungu (*H. Schouteden*); Ituri, Medje (*Christy*); Yangambi (*N. L. H. Krauss*).

Cataulacus greggi sp. n.

(Text-fig. 22)

Holotype worker. TL 5·2, HL 1·28, HW 1·30, CI 101, EL 0·56, OI 43, IOD 1·02, SL 0·62, SI 47, PW 1·24, AL 1·40, MTL 0·70.

Occipital crest absent, the occiput and vertex confluent through an obtusely rounded angle. Occipital corners dentate, these teeth flanked upon the occipital margin by a second tooth which is almost as large as that at the corner. Sides of head behind eyes strongly denticulate, the preocular tooth well-developed, separated from eye by a rudimentary second tooth which is smaller and bluntly rounded. Humeral angles acute, the pronotum marginate and strongly denticulate laterally. This margination strongly expanded and with its posterolateral portions expanded into a low, broadly triangular extension which is denticulate upon its borders. Mesonotum and propodeum denticulate laterally but with a gap between the denticulation of the former and that of the latter. Propodeum armed with a pair of long, stout, acute, divergent spines. Sutures absent from dorsal surfaces of alitrunk. Alitrunk broadest across the pronotum, narrowed at the promesonotal junction and then of approximately equal width to the bases of the propodeal spines. Subpetiolar process complex, with a rounded but prominent anteroventral angle and a long, extended posteroventral heel or spur. Subpostpetiolar process strongly developed into a ventrally directed, simple digitiform appendage. In profile the steeply sloping anterior face of the petiole meets the sloping posterior face in a narrowly rounded angle, so that no free dorsal face is differentiated. The postpetiole has strongly sloping anterior and posterior faces separated by a broadly rounded dorsum. First gastral tergite not marginate laterally.

Dorsal surfaces of head and alitrunk with a fine but quite dense rugoreticulum, the interspaces of which are finely and densely reticulate-punctate. Declivity of propodeum with a few transverse rugae between the spines. Dorsal surfaces of pedicel predominantly coarsely and irregularly longitudinally rugose with dense interstitial punctures. First gastral tergite finely and densely reticulate-punctate with a few very weak basigastric rugulae only.

All dorsal surfaces of head, body and appendages with numerous simple, blunt, stout, erect hairs.

Paratype workers. As holotype but slightly smaller and with relatively slightly broader heads. TL 4·6 – 5·0, HL 1·12 – 1·20, HW 1·18 – 1·26, CI 104 – 105, EL 0·50 – 0·54, OO 42 – 43, IOD 0·88 – 0·90, SL 0·60 – 0·64, SI 50, PW 1·08 – 1·16, AL 1·26 – ca 1·40, MTL 0·68 (2 measured).

Holotype worker, ZAIRE: Ituri Forest, Epulu, vii. 1955, no. 10 (*T. Gregg*) (MCZ, Boston).

Paratypes. 2 workers, ZAIRE: Yangambi, x. 1956 (*N. L. H. Krauss*) (BMNH).

The affinities of this medium-sized species appear to lie with *guineensis* and *erinaceus*, especially the latter. The production of the posterolateral portions of the pronotal margination is much less distinctly developed here than in *erinaceus* but is none-the-less quite marked; also *greggi* resembles *erinaceus* in sculpturation, strong development of propodeal spines, development of denticulation on the head and alitrunk and form of subpetiolar process. The major differences between them, apart from the development of the pronotal margins lie in size, sculpturation of the first gastral tergite and presence in *greggi* of a second tooth on the occipital margin close to the dentate occipital corners.

Cataulacus guineensis F. Smith

(Text-fig. 23)

Cataulacus guineensis F. Smith, 1853 : 225, pl. 20, fig. 5. Holotype worker, 'Tropical West Africa' (UM, Oxford) [examined].

Cataulacus parallelus F. Smith, 1853 : 228, pl. 19, fig. 6. Holotype female, South Africa: Cape of Good Hope [locality probably incorrect] (UM, Oxford) [examined]. **Syn. n.**

Cataulacus guineensis race *sulcinodis* Emery, 1892 : 563, pl. 15, fig. 8. Holotype worker, Ivory Coast: Assinie (*Ch. Alluaud*) (MCSN, Genoa). **Syn. n.**

Cataulacus sulcatus Stitz, 1910 : 136, figs 4–6. Syntype workers, females, males, Cameroun: Jaundestation (*Zenker*) (MNHU, Berlin) [examined]. [Synonymy by Forel, 1910*b* : 421.]

Cataulacus sulcatus var. *alenensis* Stitz, 1910 : 137. Syntype workers, Equatorial Guinea: Alen (*Tessmann*) (MNHU, Berlin) [examined]. **Syn. n.**

Cataulacus sulcatus var. *fernandensis* Stitz, 1910 : 137. Holotype worker, Equatorial Guinea: Fernando Po Is. (*Zenker*) (MNHU, Berlin) [examined]. **Syn. n.**

Worker. TL 4·5 – 8·6, HL 1·14 – 2·04, HW 1·30 – 2·40, CI 114 – 121, EL 0·38 – 0·62, OI 26 – 30, IOD 1·00 – 1·72, SL 0·74 – 1·22, SI 50 – 57, PW 1·04 – 1·94, AL 1·30 – 2·34, MTL 0·74 – 1·36 (10 measured).

Occipital crest absent although the vertex is usually separated from the occiput by an obtuse angle. More rarely the two surfaces join through a continuous curve. Occipital corners with a single acute tooth. Sides of head behind eyes denticulate, often strongly so. Pronotum marginate laterally, the margins with usually 2–4 rather large denticles and terminating posterolaterally in a large spine or tooth which is very distinct, being several times larger than any of the denticles preceding it upon the margin. Sides of mesonotum and propodeum rounded, immarginate, usually without denticles. Propodeum with a pair of very long, divergent spines. Promesonotal suture variable in development, usually present as a faint impression upon the dorsal alitrunk, rarely more strongly developed but often completely absent. First gastral tergite not marginate laterally.

Sculpturation extremely variable. Dorsum of head usually with a very fine, loose rugoreticulum which becomes much coarser behind the eyes. Interspaces finely reticulate-punctate but these are often effaced, leaving the surfaces almost smooth. Sculpturation of dorsal alitrunk basically a longitudinal rugulation or sulcate-rugation, with very finely punctured interspaces. Differences in intensity of development of this sculpturation are numerous, and the rugae are often wavy or irregular, especially upon the pronotum. Variation of sculpture on the alitrunk extends from forms in which the entirety of the dorsum is covered with strong, irregular, longitudinal rugae to forms in which the sculpturation is mostly effaced, with just a trace of rugation remaining. The space between the propodeal spines is usually strongly transversely rugose. Pedicel segments coarsely rugose. First gastral tergite reticulate-punctate with scattered fine, predominantly longitudinal rugulae.

Development of stout, erect hairs variable. Usually they are present upon all dorsal surfaces of the head and body but may be reduced both in number and size, and rarely, in some individuals may be almost completely absent. A row of outstanding hairs is always present upon the sides of the head behind the eyes and the lateral margins of the pronotum.

Intensity of sculpturation and degree of development of hairs is very often related to the size of the individual, with smaller workers tending to be more hairy and more coarsely sculptured than larger workers.

Female. TL 7·7 – 9·5, HL 1·72 – 2·06, HW 1·92 – 2·30, CI 111 – 115, EL 0·54 – 0·68, OI 28 – 29, IOD 1·48 – 1·78, SL 1·00 – 1·20, SI 49 – 52, PW 1·76 – 2·12, AL 2·32 – 2·86, MTL 1·10 – 1·34 (5 measured).

As worker, with the pronotal marginal tooth very much reduced or absent and with the propodeal spines relatively much shorter. Pronotum usually quite strongly reticulate-rugose but the mesoscutum longitudinally so. In the females examined the presence of reticulate-

punctate interstitial sculpturation upon the alitrunk is rather more strongly developed than is usual in workers, and in some females the rugation of the head has a markedly longitudinal trend.

Male. TL 6·7 – 7·3, HL 1·20 – 1·30, HW 1·42 – 1·46, CI 112 – 118, EL 0·48, OI 32 – 34, IOD 1·10, SL 0·64 – 0·70, SI 45 – 48, PW 1·18 – 1·22, AL 1·14 – 1·22, MTL 1·00 – 1·14 (4 measured).

Structure of head basically similar to that of worker, with dentate occipital corners and denticulate sides behind the eyes. Anterior arms of notauli strongly developed, extending almost the length of the sclerite, scarcely or not at all joined before the suture so that the posterior notaular arm is extremely short or absent. Sides of pronotum marginate and denticulate; propodeum armed with a pair of short but strong, acute spines. Head strongly reticulate-punctate with scattered fine rugulae; the latter tending to form a loose reticulum behind the level of the ocelli. Pronotum similarly sculptured, the reticulations usually widely spaced. Anteromedian portion of mesoscutum with a long, narrowly V-shaped area of unsculptured, polished cuticle; the remainder of the segment sculptured as the pronotum. Propodeum very heavily and coarsely rugose, strongly reticulate-punctate. Erect hairs numerous everywhere.

The majority of the synonyms noted above were based on variation in sculpturation in the worker, but *parallelus* was founded on what is now known to be a perfectly ordinary female of *guineensis*. The only strange thing about *parallelus* is its type-locality, given by Smith as Cape of Good Hope. Arnold (1917 : 402) noted that the species did not appear to have been recorded since Smith's time and the present survey seems to indicate that South Africa is outside the range of *guineensis*. It seems probable that the locality is an error.

In Stitz's description of *sulcatus* he recognizes the affinity of his species to *erinaceus* but was not aware that he was dealing with a known species. The synonymy of *sulcatus* to *guineensis* occurred in the same year as the publication by Stitz, but the varieties *alenensis* and *fernandensis* continued to be used. These were based on smaller workers and sculptural differences were invoked to maintain their separation. However, Santschi (1937*b* : 102) noted that the individuals of the var. *alensis* [sic] were very variable in sculpturation, and the present study has shown that these variations are in fact of quite common occurrence in normal nests.

Probably the most common species of the genus in the forested areas of West and Central Africa in which it is found. The worker, which shows a remarkable size range even in a single colony, is distinguished by the presence of a well-developed spine or tooth upon the posterolateral portion of the pronotum. Other species sharing this feature are separable on characters of sculpturation and size.

Mature nests are usually populous, containing several hundred workers, and are formed in rotten branches of otherwise healthy trees, often a considerable distance above the ground. The nests are usually begun by a queen entering a tunnel previously made in the branch by wood-boring beetles or termites; the galleries are later extended by the ants themselves. The preference seems to be for branches which are quite unsound and extensively tunelled previously, either by beetles or termites, and the further activities of the ants tends to weaken the branches to such an extent that they may fall off during storms. This was actually observed by the author in 1969 at the Cocoa Research Institute of Nigeria station at Gambari, when a rotten branch of a cocoa tree containing a large colony broke away during a rainstorm. The ants were seen later moving their brood up an adjacent cocoa tree where they

took up residence in another rotten branch. Forel (1916 : 427) recorded this species inhabiting an abandoned wasp nest on the trunk of a tree at Motombé on the Okiavo, Zaire, and noted that at St. Gabriel *guineensis* was running amicably with a *Crematogaster* species. This last is not unknown and I have confirmed that *guineensis* is able to occupy trees in areas dominated by both *Crematogaster striatula* Emery and *Cr. clariventris* Mayr; however, *guineensis* seems to be excluded from areas infested with the rather belligerent *Cr. depressa* (Latreille), along with many other arboreal forms. Workers of *guineensis* have been observed tending aphids and small coccids but, although the workers spend much time wandering upon the tree and occasionally descend to the ground, predatory behaviour has not been noted.

When approached by a potential predator the reaction of the individual ant varies, apparently with the size of the attacker. Workers of *guineensis* occurring upon a tree dominated by *Oecophylla longinoda* (Latreille) will try to avoid contact with workers of that species. If that is impossible, they become completely immobile and rely upon their armour for protection. If, however, the aggressor persists in its attentions, or if the predator is large, the *guineensis* worker rolls up, releases its grip on the bark and escapes by falling into the undergrowth. Wheeler (1922*a* : 199) recorded this species from the stomachs of the toads *Bufo tuberosus* Günther and *B. polycercus* Werner.

MATERIAL EXAMINED.

LIBERIA: Bendija (*W. M. Mann*); Gibi (*W. M Mann*); Belleyella (*W. M. Mann*); Reputa (*W. M. Mann*); Cape Mount (*W. M. Mann*); Monrovia (*O. F. Cook*); Imi (*C. Blickenstaff*). IVORY COAST: Divo (*C. A. Collingwood*); Orstom Res. Sta., near Abidjan (*W. L. Brown jr.*). GHANA: Tafo (*B. Bolton*); Tafo (*C. A. Collingwood*); Bunso (*D. Leston*); Kibi (*D. Leston*); Adeiso (*D. Leston*); Kade (*J. Majer*); Sajimasi (*D. Leston*); Pimpimso (*Strickland*); Ankasa Forest Reserve (*O. W. Richards*); Mampong (*P. M. Room*); Larteh (*D. Leston*); Enchi (*D. Leston*). NIGERIA: Ibadan (*J. T. Medler*); Evin-Odo (*J. T. Medler*); Old Calabar (ex *F. Smith* coll.); Gambari (*B. Bolton*); Gambari (*L. O. Oyatobo*); Olokemeji (*Bridwell*); Ararome (?). CAMEROUN: Mbale Mayo to Ekingli (*G. Schwab*). ZAIRE: Miss. St. Gabriel (*H. Kohl*); Leopoldville (*Lang & Chapin*); Stanleyville (*Lang & Chapin*); Bolobo (*Lang & Chapin*); Eala (*H. Schouteden*); Yambata (*De Giorgi*); Mongende (*H. Schouteden*); Kisantu (*H. Schouteden*); Kunungu (*H. Schouteden*); Yumbi (*H. Schouteden*); Luebo, Kamaiembi (*H. Schouteden*); Basongo (*H. Schouteden*); Kasai, Dumbi (*H. Schouteden*); Luebo (*H. Schouteden*); Kasai, Ngombe (*H. Schouteden*); Yambuya (*Bequaert*); Irebu (*H. Schouteden*); Boma (*H. Schouteden*); Stanleyville (*Bequaert*); S. of Walikale (*E. S. Ross & R. E. Leech*); Lukolela to Basoko (*H. O. Lang*); Akengi (*H. O. Lang*).

THE SPECIES OF THE INDO-AUSTRALIAN AND ORIENTAL REGIONS

In all, some 17 species of *Cataulacus* have been recorded from the Indo-Australian and Oriental regions, one species of which (*longinodus*) is known only from the female caste. Of the 16 species in which the worker is known, females are known

for ten of them and males are known for nine. The association of some isolated males and females in the present study has been tentative and where this is the case the description under the individual species headings has been quoted as 'putative male', etc.

Basing the study upon the worker caste the species fall into three informal groups, a summary of which is given below with a synonymic synopsis.

What little is known of the biology of the species is mostly to be found in the publications of Wroughton (1892) and Bingham (1903). Details of the biology are included under the individual species headings, but it is probably safe to say that the biologies of the species do not differ markedly from those of species of the Ethiopian region, which are rather better documented in some cases.

The species are rather thinly distributed, and as one moves eastwards through the island systems and towards New Guinea the number of recorded species gradually falls off, as it also does along the Sumatra–Timor island chain. These may be illustrated by the following west–east island series and the number of species noted from each:

West Malaysia 7, Borneo 6, Philippines 3, Sulawesi 1, Waigeo 1, New Guinea 0; and similarly: Sumatra 6, Java 2, Sumbawa 0.

***granulatus*-group**

- ***granulatus*** (Latreille)
  - *hispidus* F. Smith **syn. n.**
- ***hispidulus*** F. Smith
  - *brookei* Forel **syn. n.**
- ***longinodus*** Forel
- ***marginatus*** **sp. n.**
- ***muticus*** Emery
- ***nenassus*** **sp. n.**
- ***setosus*** F. Smith
- ***simoni*** Emery
  - *granulatus* race *andamanensis* Forel **syn. n.**

***taprobanae*-group**

- ***catuvolcus*** **sp. n.**
- ***chapmani*** **sp. n.**
- ***flagitiosus*** F. Smith
- ***latissimus*** Emery
  - *latissimus* var. *mimula* Menozzi **syn. n.**
- ***latus*** Forel
- ***praetextus*** F. Smith
  - *praetextus* var. *sumatrensis* Forel **syn. n.**
- ***reticulatus*** F. Smith
  - *reticulatus* var. *minor* F. Smith **syn. n.**
- ***taprobanae*** F. Smith

***insularis*-group**

- ***insularis*** F. Smith
  - *horridus* F. Smith **syn. n.**

Keys to the species of the Indo-australian and Oriental Regions

Key to Workers

Note: the worker of *longinodus* is not known.

1 Sides of alitrunk without margination, the dorsum rounding into the sides and with a laterally projecting, broad, blunt tubercle at the level of the promesonotal junction. Occipital corners drawn out into a pair of long, acute, broadly triangular spines. Sculpturation on dorsum of alitrunk an extremely coarse foveolate-rugulation with a superimposed fine reticulate-puncturation. (West Malaysia, Borneo, Sumatra) . . . . . ***insularis*** (p. 84)

– Sides of alitrunk marginate, at least on the pronotum; the margination consisting of a flange, ridge or acute angle, often denticulate, separating the dorsum from the sides. No laterally projecting, broad, blunt tubercle present at the level of the promesonotal junction. Occipital corners usually dentate but never projecting as above. Sculpturation of dorsal alitrunk finer, usually a reticulate-rugulation and a fine and dense puncturation 2

2 Larger, very broad species, HL > 1·35 (usually 1·50 or more), HW > 1·60, IOD > 1·30, with relatively very small eyes, OI < 25 3

– Smaller, less broad species, HL < 1·35, HW < 1·60, IOD 1·20 or less, with relatively larger eyes, OI > 25 4

3 First gastral tergite sharply marginate laterally throughout its length. Lateral margins of pronotum and propodeal spines expanded into broad, projecting flanges or plates. Very broad-headed species CI > 140. (West Malaysia, Singapore, Borneo, Sumatra) . . . . . ***latissimus*** (p. 77)

– First gastral tergite without lateral margination. Lateral margins of pronotum and propodeal spines not expanded into broad, projecting flanges or plates. Less broad-headed species, CI < 135. (India, Burma) . . . . . ***latus*** (p. 78)

4 Dorsum of head behind clypeus and dorsum of pronotum without short, erect hairs; a few short hairs may be present around the eyes and on the margins of the head and alitrunk, projecting laterally. In profile the pronotal dorsum usually without minute, raised peaks or tubercles 5

– Dorsum of head behind clypeus and usually dorsum of pronotum with numerous short, erect hairs, either simple or clavate; these are also present on the margins of the head and alitrunk, projecting laterally. In profile the pronotal dorsum with a number of minute raised peaks or tubercles, especially on the anterior half 8

5 First gastral tergite marginate laterally, the margination consisting of a ridge or acute angle separating the dorsum of the sclerite from the sides . . . 6

– First gastral tergite not marginate laterally, the dorsum of the sclerite rounding into the sides 7

6 Occipital crest complete, raised medially into a projecting ridge (Text-fig. 36). Mesonotum covered with a fine rugoreticulum. Dorsal surfaces of femora without stout, erect hairs. Smaller species, HW < 1·15, CI < 112, IOD < 0·85. (West Malaysia, Borneo, Sumatra) . . . . . ***praetextus*** (p. 80)

– Occipital crest complete and sharp but not raised medially into a projecting ridge (Text-fig. 37). Mesonotum with regular, more or less parallel longitudinal rugae. Dorsal surfaces of femora with distinct stout, blunt, erect hairs. Larger species HW > 1·20, CI > 112, IOD > 0·90. (Philippines) . . . ***catuvolcus*** (p. 74)

7 Occipital crest complete, the median portion raised into a low, posteriorly projecting ridge (Text-fig. 35). Entirety of dorsal alitrunk covered with a fine rugoreticulum. (Borneo) . . . . . ***reticulatus*** (p. 82)

– Occipital crest absent, the dorsum of the head curving into the occiput. Dorsum of pronotum with a rugoreticulum but the mesonotum and propodeum with a series of regular, approximately parallel, longitudinal rugae. (Philippines) ***chapmani*** (p. 75)

8 Propodeal spines long, divergent, broad at the base and gradually tapering apically (Text-figs 31, 41); each spine distinctly longer than half the basal distance separating it from its twin, usually as long or longer than the complete distance separating the spines 9

– Propodeal spines short to virtually absent; weakly or not at all divergent, slightly or hardly tapering from base to apex, usually widely separated, and each spine is usually shorter than half the basal distance separating it from its twin (Text-figs 38, 39) 12

9 On the dorsum of the alitrunk the reticulate-rugulation tending to lose its cross-meshes and to become effaced on the mesonotum where it is secondary to a fine, dense reticulate-puncturation. Dorsa of alitrunk and pedicel with only a few scattered short, thick erect hairs, very indistinct 10

– On the dorsum of the alitrunk the reticulate-rugulation coarse and distinct over the entire surface, not fading out nor becoming secondary to a reticulate-puncturation on the mesonotum. Dorsa of alitrunk and pedicel with numerous distinct short, thick erect hairs, very conspicuous 11

10 In profile the mesonotum forming a short but distinct step at its junction with the propodeum. Pronotum on each side with a prominent rectangular flange, denticulate on its outer margin (Text-fig. 31). The mesonotum with a number of regular, parallel, low, longitudinal rugae. (Sulawesi) . . ***flagitiosus*** (p. 76)

– In profile the dorsa of the mesonotum and propodeum forming a continuous convexity at their junction. Pronotum denticulate on each side but without a prominent rectangular flange (Text-fig. 32). The mesonotum without regular, parallel, low, longitudinal rugae. (India, Ceylon) . . . ***taprobanae*** (p. 83)

11 First gastral tergite finely longitudinally rugose throughout its length over the entire surface of the sclerite, the rugae distinct on the centre of the disc. Head longer, HL > 1·10, CI 105 or less. (Java) . . . . . ***nenassus*** (p. 70)

– First gastral tergite not finely longitudinally rugose throughout its length over the entire surface of the sclerite; at least the disc not rugose. Head shorter, HL < 1·10, CI 109 or more. (Philippines, Moluccas, New Guinea: Waigio Is.) ***setosus*** (p. 71)

12 Propodeal spines represented by a pair of small, obtuse, blunt tubercles. Node of petiole in dorsal view distinctly longer than broad. (Burma) . . ***muticus*** (p. 69)

– Propodeal spines distinct; if very short or dentiform they are acute and the node of the petiole in dorsal view is broader than long 13

13 Hairs on dorsum of head and on clypeus very short, clavate or subglobose. Sculpturation of mesonotum and propodeal dorsum predominantly of longitudinal rugae. In dorsal view the alitrunk without a distinct notch or constriction between the mesonotum and propodeum. Small species, HL 1·00 or less, PW < 0·90, with relatively large eyes, OI > 36. (Ceylon, Andaman Is.) ***simoni*** (p. 72)

Hairs on dorsum of head and on clypeus usually relatively long, simple, stout and blunt. If some cephalic hairs are clavate then the sculpturation of the mesonotum and propodeal dorsum is predominantly a rugoreticulum and in dorsal view the alitrunk has a distinct notch or constriction between the mesonotum and propodeum. Larger species, HL > 1·00, PW > 0·95, with relatively smaller eyes, OI < 36 14

14 Subpetiolar process complex; anteroventrally with a bluntly rounded angle or

tooth and posteroventrally with a long, posteriorly directed spur. Dorsum of petiole in profile low, only shallowly convex (Text-fig. 5). (Borneo, Sumatra) ***hispidulus*** (p. 66)

– Subpetiolar process a simple rectangular or subrectangular rod of varying size and shape; the posteroventral angle may be acute but is without a projecting long spur. Dorsum of petiole in profile high and strongly convex (Text-fig. 6) . . 15

15 First gastral tergite very strongly and distinctly marginate laterally throughout its length, the dorsum markedly separated from the lateral portions of the sclerite. In dorsolateral view the marginations appear as strong ridges. (China: Hainan Is.) . . . . . ***marginatus*** (p. 68)

– First gastral tergite not marginate, the dorsum rounding into the lateral portions of the sclerite. In dorsolateral view only an uninterrupted, rounded surface is visible. (Throughout Oriental region, West Malaysia, Borneo, Sumatra, Java) ***granulatus*** (p. 64)

Key to Known Females (Queens)

1 Dorsum of pronotum seen in profile without short, erect hairs although one or two may be present on the margins 2

– Dorsum of pronotum seen in profile with short, erect hairs present, usually numerous, but at least with a transverse row just in front of the promesonotal suture . . 3

2 Dorsum of pronotum distinctly reticulate-rugose. Head reticulate-rugose, the cross-meshes conspicuous, especially between the eyes and the ocelli. Alitrunk narrower, PW < 1·16. (West Malaysia, Borneo, Sumatra) . ***praetextus*** (p. 80)

– Dorsum of pronotum distinctly longitudinally rugose; cross-meshes between the rugae few or none on the disc, more distinct at the sides. Head faintly reticulate-rugose with a distinctly longitudinal direction, the cross-meshes somewhat effaced. Alitrunk broader, PW > 1·16. (Philippines) . . ***catuvolcus*** (p. 74)

3 Occipital corners drawn out into long, broad, coarse triangular spines. (West Malaysia, Borneo, Sumatra) . . . . . ***insularis*** (p. 84)

– Occipital corners acute or armed with a denticle or short tooth, never drawn out into broad, coarse, triangular spines as above 4

4 Large species, HL > 1·80, HW > 2·00, the eyes relatively small, OI 25 or less. Frontal groove usually distinct between frontal triangle and median ocellus. (India, Burma) . . . . . ***latus*** (p. 78)

– Smaller species, HL < 1·60, HW < 1·70, the eyes relatively large, OI 29 or more. Frontal groove indistinct or absent 5

5 Transverse occipital crest separating vertex from occiput broken or incomplete medially so that the vertex runs into the occipital surface at that point, or the crest broadly and deeply concave medially in full-face view, V- or U-shaped, or both 6

– Transverse occipital crest complete, not broken medially, usually beset throughout its length with denticles from which short hairs arise; the crest not broadly and deeply concave in full-face view 9

6 Subpetiolar process with an extremely long posteroventral spur which is blunt apically. Petiole in profile with the dorsum low and only shallowly convex. (Borneo, Sumatra) . . . . . ***hispidulus*** (p. 66)

– Subpetiolar process simple, without a posteroventral long spur. Petiole in profile with the dorsum high and distinctly convex 7

7 Dorsum of head behind clypeus, and pronotum, with abundant erect hairs. Petiole in profile with a weakly convex anterior face and a convex dorsal surface which rounds into the sloping posterior face. (Throughout Oriental region, West Malaysia, Borneo, Sumatra, Java) . . . . . ***granulatus*** (p. 64)

– Dorsum of head behind clypeus, and pronotum, with a few short, inconspicuous hairs, usually reduced on the pronotum to a single row just in front of the promesonotal suture. Petiole in profile with a flat, sloping anterior face forming an approximate right-angle with the shallowly convex and sloping posterior face, without a dorsal face between them. (India, Ceylon) . . . ***taprobanae*** (p. 83)

8 Hairs on dorsum of head and pronotum strongly clavate or suborbicular, very short. Small species, HL < 1·10, IOD < 0·80, PW ca 0·90, with relatively large eyes, OI ca 40. (Ceylon, Andaman Is.) . . . . . ***simoni*** (p. 72)

– Hairs on dorsum of head and pronotum simple, short and thick or virtually absent. Larger species, HL 1·20 or more, IOD > 0·90, with relatively smaller eyes, OI < 36 usually. If OI approaches 40 then PW > 1·00 9

9 First gastral tergite finely longitudinally rugose throughout its length over the centre of the disc. (Java) . . . . . ***nenassus*** (p. 70)

– First gastral tergite not finely longitudinally rugose throughout its length over the centre of the disc 10

10 Upper surfaces of middle and hind tibiae yellow, the lower surfaces black or dark brown. Propodeal spines short and narrow, hardly tapering in their apical halves. Smaller species, PW 1·08, HW 1·20, with the head as broad as long (CI 100) and with eyes relatively large, OI 40. (Sumatra). . ***longinodus*** (p. 67)

– Upper surfaces of middle and hind tibiae similar in colour to lower surfaces. Propodeal spines tapering from base to apex, broadly triangular. Larger species, PW > 1·20, HW > 1·30, with the head broader than long (CI 105 or more) and with relatively smaller eyes, OI 36 or less. (Philippines, Moluccas, New Guinea: Waigeo Is.) . . . . . ***setosus*** (p. 71)

Provisional Key to Known Males

1 Dorsal surfaces of head, pronotum and first gastral tergite in profile with numerous erect hairs 2

– At least dorsal surfaces of head and pronotum without erect hairs; if present on first gastral tergite then they are confined to the posterior third of the sclerite. . 7

2 Occipital corners produced into a pair of very long, broadly triangular spines. (West Malaysia, Borneo, Sumatra) . . . . . ***insularis*** (p. 84)

– Occipital corners with a denticle or tooth but not produced into long spines . . 3

3 Large, broad-headed species, HW > 1·30, IOD > 1·10, with relatively small eyes, OI < 30 4

– Smaller, narrower-headed species, HW < 1·30, IOD < 1·10, with relatively larger eyes, OI > 30 5

4 First gastral tergite marginate laterally from the base to the level of the spiracle. Pronotum with a strong, flange-like expansion at each side. Very large species, HL 1·36, HW 1·74, PW 1·54. (West Malaysia, Borneo, Sumatra, Singapore) ***latissimus*** (p. 77)

– First gastral tergite not marginate laterally to the level of the spiracle. Pronotum without a flange-like expansion at either side. Smaller species, maximum dimensions of specimens examined, HL 1·26, HW 1·60, PW 1·44. (India, Burma) . . . . . ***latus*** (p. 78)

5 First gastral tergite with basigastric costulae and some extremely fine longitudinal rugulae running the length of the dorsum on the outer portions of the sclerite. (Java) . . . . . ***nenassus*** (p. 70)

– First gastral tergite with basigastric costulae only. 6

6 Posterior arm of notauli absent; sides of pronotum indistinctly denticulate. (India, Ceylon) . . . . . ***taprobanae*** (p. 83)

– Posterior arm of notauli present as a groove or impression; sides of pronotum conspicuously denticulate. (Throughout Oriental region, West Malaysia, Borneo, Sumatra, Java) . . . . . ***granulatus*** (p. 64)

7 First gastral tergite without erect hairs, the remaining tergites each with a strong transverse row of long, close-set, stout hairs. (West Malaysia, Borneo, Sumatra) ***praetextus*** (p. 80)

– First gastral tergite with some erect hairs on the posterior third of its length, the remaining tergites with hairs which are not, however, arranged in close-set rows . 8

8 First gastral tergite marginate laterally, the margination strongest anteriorly, fading out behind. (Philippines) . . . . . ***catuvolcus*** (p. 74)

– First gastral tergite not marginate laterally. (Philippines) . ***chapmani*** (p. 75)

The *GRANULATUS*-Group

The group contains eight species characterized by their abundance of conspicuous short, erect, stout and blunt hairs upon all dorsal surfaces of the head and body and by the coarse nature of the sculpturation which in most cases is a rugoreticulum upon the head and dorsal alitrunk. The reticulae are often raised into minute peaks or tubercles at their points of intersection. The interspaces of the rugoreticulum are usually finely and densely reticulate-punctate, but in some species the puncturation is reduced and the interspaces are dully shining. Denticulation of the margins of the head and alitrunk is always well developed and all members of the group present a very rough, pilose aspect.

In the majority of species the propodeal spines are short or very short, and widely separated basally, but in *setosus* and *nenassus* they are elongate and divergent.

It is interesting to note the presence of very short, strongly clavate or subglobular hairs in *simoni*, the smallest species of the regional fauna, as this character compares well to similar developments in some of the smaller species of the Ethiopian region. The possible advantages of hairs of this nature are unknown, but some populations of *granulatus*, the most widespread species of the group, develop hairs which are very similar.

Six of the eight species belong to two complexes of closely related species. The first and largest complex, centring on *granulatus* itself also includes *marginatus*, *hispidulus* and *muticus* in which the occipital crest tends to be incomplete or broken medially and the propodeal spines are short and very widely separated basally. The second complex includes *setosus*, *nenassus* and most probably *longinodus*, the worker of which is not known. In these species the occipital crest is complete and strongly developed, armed with denticles throughout its length, and the propodeal spines are long and strong, paralleling the condition usual in the *taprobanae*-group.

The majority of the species are distributed to the west of the 120th meridian of easterly longitude, which runs roughly through the islands of Luzon, Sulawesi and Flores; only a single species, *setosus*, is found to the east of that line. At present the greatest number of species of the group are found on Java, but this picture will probably change as collections from other localities become larger.

Cataulacus granulatus (Latreille)

(Text-fig. 6)

Formica granulata Latreille, 1802 : 275, pl. 12, fig. 75a-d. Holotype worker, 'GRAND-INDES' (location of type not known).
Cataulacus granulatus (Latreille) F. Smith, 1853 : 226.
Cataulacus hispidus F. Smith, 1876 : 611, pl. 11, fig. 11. Holotype worker, SINGAPORE (UM, Oxford) [examined]. **Syn. n.**

Worker. TL 4·2 – 5·6, HL 1·06 – 1·30, HW 1·22 – 1·52, CI 105 – 120, EL 0·40 – 0·46, OI 27 – 33, IOD 0·90 – 1·20, SL 0·60 – 0·70, SI 45 – 49, PW 0·98 – 1·31, AL 1·16 – 1·50, MTL 0·60 – 0·77 (20 measured).

Occipital crest usually weakened or incomplete medially, the lateral portions of the crest rather poorly defined in most specimens but equipped with a few denticles. Sides of head behind eyes denticulate, the occipital corner itself with a triangular tooth, decidedly larger than the denticles of the occiput or sides. Sides of alitrunk denticulate throughout their length, the denticles extending onto the lateral margins of the propodeal spines. Pronotum broad, the mesonotum narrowing posteriorly to a notch or impression separating it from the propodeum. Propodeal spines varying in length, may be reduced to a pair of small, acute teeth but are always widely separated, little divergent and shorter than half the distance separating the one from the other. Petiole in dorsal view massive, larger than the postpetiole, both segments broader than long, sometimes distinctly so. Subpetiolar process simple or with the postero-ventral angle acute or dentiform, but never drawn out into a long, spur-like projection. In profile the anterior, dorsal and posterior faces of the petiole node forming a more or less continuous convexity so that the node is roughly dome-like. Sides of first gastral tergite not marginate. In dorsal view the basal portion of the sides is jagged or denticulate, the basal border itself is not.

Sculpturation of dorsum of head and alitrunk a rugoreticulum with reticulate-punctate interspaces, very variable in intensity, and the rugae with a tendency to assume a longitudinal direction upon the mesonotum and propodeal dorsum. The rugoreticulum varies from rather coarse, close set and flattened meshes to a very fine, loose organization in which the meshes are narrow and sharply defined. The interspaces are either finely and densely reticulate-punctate, more or less mat or dully shining, or the puncturation is quite superficial, leaving the interspaces shiny. First gastral tergite very finely reticulate-rugose with punctate interspaces and with a tendency towards reduction of the rugae in smaller individuals.

Erect hairs are present on all dorsal surfaces and around the margins of the head, alitrunk, pedicel and gaster and are numerous on the appendages. The hairs are usually short, broad and blunt, but in some populations those of the head and dorsal alitrunk may be very short and more or less clavate.

Female. TL 6·4 – 7·2, HL 1·40 – 1·56, HW 1·48 – 1·60, CI 102 – 107, EL 0·46 – 0·50, OI 29 – 31, IOD 1·16 – 1·30, SL 0·70 – 0·78, SI 44 – 49, PW 1·38 – 1·50, AL 1·96 – 2·14, MTL 0·62 – 0·82 (13 measured).

Similar to worker, with denticulation reduced on sides of head behind eyes and on the lateral portions of the occipital crest. The denticulation of the sides of the pronotum distinct but reduced or even absent on the propodeal margins. Propodeal spines a pair of short teeth. Sculpturation of head and pronotum similar to worker but the rugae of the mesoscutum and scutellum longitudinal, with a few cross-meshes. First gastral tergite usually with a distinct rugoreticulum on the basal quarter of its length which fades out posteriorly to a few weak, longitudinal rugulae. The entire surface finely and densely reticulate-punctate. Distribution of erect hairs as in worker but they are proportionately shorter in the present caste. Those upon the dorsum of the head (but not the margins) appear always to be very short and inconspicuous, and are often clavate or stud-like, even in populations in which the hairs are normal in the workers.

Male. TL 4·8 – 5·4, HL 0·96 – 1·08, HW 1·10 – 1·24, CI 107 – 114, EL 0·36 – 0·40, OI 32 – 35, IOD 0·86 – 0·94, SL 0·56 – 0·64, SI 50 – 52, PW 0·92 – 1·04, AL 1·49 – 1·74, MTL 0·72 – 0·76 (5 measured).

Occipital crest incomplete medially, laterally with only one or two denticles. Sides of head behind eyes denticulate, the occipital corner with a triangular, short tooth. Lateral margins of pronotum and propodeum weakly denticulate, the propodeum with a pair of small teeth. Anterior arms of notauli developed and cross-ribbed, the posterior arm usually represented by a broad, shallow, longitudinal impression, more rarely by a distinct groove. Parapsidal furrows poorly defined, inconspicuous. Sculpturation of dorsum of head a fine loose rugo-reticulum with reticulate-punctate interspaces. On the alitrunk the sculpturation is variable. Pronotum sculptured as head but the reticulum more dense; this may extend onto the mesoscutum, scutellum and propodeal dorsum but usually the cross-meshes tend to disappear, leaving these areas longitudinally rugose. Pedicel reticulate-rugose with punctate interspaces, often with the longitudinal rugae predominant. Gaster everywhere finely and densely reticulate-punctate with basigastric costulae usually present. Erect hairs present on all dorsal surfaces of head and body, simple and blunt, relatively long.

C. granulatus is the most widely distributed species of the genus in the Indo-Australian and Oriental regions and also appears to be the most common and most variable of the known forms. The species ranges from Nepal to Ceylon and through Thailand and Burma to Hainan Is., Borneo, Sumatra and Java. It was reported from Burma and Tenasserim by Emery (1889) and from Dehra Dun in Uttar Pradesh by Forel (1906). Bingham (1903) gave the distribution as Burma and Tenasserim 'extending in the Malayan subregion to Borneo and Sumatra'. Bingham also states that this is one of the two species with which he was well acquainted (the other being *taprobanae*) and which he always found wandering about on the bark or leaves of trees and nesting in hollow branches.

Apart from the characters given in the key, one of the best features available for the recognition of the species is the relatively massive and coarsely sculptured petiole. When one has acquired an eye for the characters of this genus the general build and appearance of the segments of the pedicel in *granulatus* are unmistakable and are only likely to be confused with the very closely related *marginatus*, which is, however, separable on the structure of the first gastral tergite.

There is considerable variation in the length of the propodeal spines amongst the workers. Populations from Hainan Is. contain some individuals in which the spines are reduced to a pair of very small but acute teeth, and in some cases there are noticeable differences in spine length amongst members of the same series. Specimens from Java and the Andaman Is. have the hairs on the cephalic dorsum, and usually also the alitrunk, very small and somewhat clavate. In this condition the hairs resemble those found on the head of the female rather than the form usually associated with the worker caste. Sculpturation is variable in detail in the worker, as has been noted above. Usually it is the smaller individuals which possess the finer and looser rugoreticulum and more shining interspaces, but this does not by any means appear to be a hard and fast rule.

MATERIAL EXAMINED.

NEPAL: Baredamar (*E. I. Coher*). INDIA: Uttar Pradesh, Dehra Dun (*Smythies*); Assam, Jorhat (*A. C. Cole*); Andaman Islands, Haddo (*C. Paiva*). CEYLON: Kandy

(*Bingham*). BURMA: Mandalay (*Bingham*); Pegu Yoma (*Bingham*); Bhamo (*L. Fea*); Maymyo (*Bingham*); Taungoa (*E. Y. Watson*). THAILAND: no data (*T. S. Uyeda*); Chiengmai (*A. F. G. Kerr*); Doi Sutep, 1200 ft (*A. F. G. Kerr*); Biserat (*Annandale & Robinson*). CHINA: Hainan Is., Ta Hiau (*J. L. Gressitt*); Hainan, Liamui (*J. L. Gressitt*); Hainan, Loi Mofia (*J. L. Gressitt*). MALAYA: Kuala Lumpur (*H. M. Pendlebury*). SINGAPORE: no data (*Baker*). BORNEO: Sarawak, Mt. Matang (*G. E. Bryant*). JAVA: Semarang (*Jacobson*); Semarang (*L. G. E. Kalshoven*); Buitenzorg (*Verbeek*). SUMATRA: Siantar, Pematang (*W. M. Mann*); Moera Enim (*W. M. Mann*).

Cataulacus hispidulus F. Smith

(Text-figs 5, 39)

Cataulacus hispidulus F. Smith, 1865 : 76, pl. 4, fig. 7. Holotype worker, SUMATRA (*A. R. Wallace*) (UM, Oxford) [examined].

Cataulacus brookei Forel, 1901*a* : 378. Syntype workers, female, male, BORNEO: Sarawak (*Haviland*) (MHN, Geneva) [examined]. **Syn. n.**

Worker. TL 4·6 – 5·8, HL 1·10 – 1·30, HW 1·31 – 1·50, CI 112 – 123, EL 0·40 – 0·48, OI 30 – 34, SL 0·64 – 0·72, SI 46 – 48, PW 1·14 – 1·25, AL 1·14 – 1·22, MTL ca 0·70 (6 measured).

Occipital crest incomplete medially, the vertex rounding into the occiput. Occipital corners with a relatively large tooth followed by three or four smaller denticles along the occipital crest on each side. Sides of head behind eyes strongly denticulate. Edges of frontal carinae usually jagged, often more strongly so on the posterior than the anterior half, which in some cases is virtually smooth. Alitrunk with a massive appearance in dorsal view, short and broad, with the pronotal margins strongly denticulate. Propodeal spines narrow and short, each one less than half the length of the distance separating it from its twin. Petiole short and low in profile, the anterior face sloping gently into the very weakly convex dorsal surface. The latter curves posteriorly to the junction with the postpetiole, there being no distinct free posterior face to the petiole. Subpetiolar process large and complex, anteroventrally with a bluntly rounded angle or tooth and posteroventrally with a long, posteriorly directed spur. First gastral tergite short, broad, convex, not marginate laterally.

Sculpturation of dorsum of head and alitrunk a rather coarse and well-defined rugoreticulum, the interspaces of which are feebly reticulate-punctate and shining. First gastral tergite sculptured as alitrunk but the rugoreticulum much finer and the puncturation of the interspaces more distinct. Propodeal declivity finely and densely reticulate-punctate.

All dorsal surfaces of head, body and appendages with abundant thick, blunt hairs, yellowish or white in colour and very distinct. On the head and alitrunk the hairs tend to arise from the points of intersection of the meshes of the reticulum.

Female. TL 7·2, HL 1·56, HW 1·66, CI 106, EL 0·50, OI 30, IOD 1·34, SL 0·74, SI 44, PW 1·54, AL 1·97, MTL 0·94.

As worker but denticulation of sides of head reduced to small, blunt tubercles. Propodeal spines shorter than in worker but still distinct. Subpetiolar process with the posteroventral spur more strongly developed, very long and conspicuous. First gastral tergite much longer than broad, length ca 2·40, width ca 1·70. Sculpturation of head and pronotum as worker with a similar arrangement of short, blunt hairs, but the interspaces of the rugoreticulum are less shiny and have a granular appearance. Mesoscutum and scutellum coarsely longitudinally rugose with a few transverse meshes, many of which are incomplete. First gastral tergite with an extremely fine rugoreticulum, coarsest basally, and a dense reticulate-puncturation.

In the centre of the sclerite is a short, longitudinal strip which is virtually devoid of sculpturation and contrasts with the surrounding areas.

Male. The head of the male examined (syntype of *brookei*) is missing. PW 0·92, A: 1·64, MTL 1·75.

Notauli well developed, the anterior arms with some distinct cross-ribs. Limits of the posterior arm poorly defined laterally, the groove distinct and broad. Parapsidal furrows absent or almost completely masked by the sculpturation, visible on one side as a slightly more shining strip in the syntype of *brookei*. Propodeal spines reduced to a pair of minute but acute teeth. Subpetiolar process short and blunt, without the posteroventral spur characteristic of the worker and female castes. Sculpturation of alitrunk a fine rugoreticulum, coarsest on the pronotum, the interspaces reticulate-punctate. Pedicel similarly sculptured but gaster with only a very fine, superficial reticulate-puncturation. Abundant short, thick white hairs present as in the other castes. Exposed portion of parameres smooth and shining, unsculptured apart from the pits from which hairs arise, strongly arcuate in ventral view.

Of the species immediately related to *granulatus*, *hispidulus* is the most easily distinguished. The shape of the petiole and its ventral process is distinctive and will effectively separate the species from all others in the Indo-Australian and Oriental regions, but the general body form of the worker renders it very easily identifiable when one is acquainted with the genus. The short, stocky build of the body, sharp rugoreticulum with shining interspaces and the abundant hairs form an easily recognizable combination of characters, not seen in any other ally of *granulatus*.

Emery (1887) gave some short notes on *hispidulus* collected in Borneo by Doria and Beccari and appears to have identified the species correctly. It seems probable that when Forel (1901*a*) described *brookei* he was unaware of these notes and was misled by the valueless description of Smith (1865) into assuming that he had a new species. Dalla Torre (1893) gave *hispidulus* as a variety of *granulatus*, but Donisthorpe (1932), when reviewing Smith's types, voiced the opinion that *hispidulus* was a good species, as has proved to be the case.

MATERIAL EXAMINED.

SUMATRA: no data (*Smith* coll., may be of type series). BORNEO: Sarawak, Mt. Bongo (*J. Hewitt*); Kuching (*J. Hewitt*); Sandakan (*Baker*).

Cataulacus longinodus Forel stat. n.

Cataulacus granulatus var. *longinoda* Forel, 1912 : 60. Holotype female, SUMATRA: Indrapura (*Tritschler*) (MHN, Geneva) [examined].

Holotype female. TL 5·5, HL 1·20, HW 1·20, CI 100, EL 0·48, OI 40, IOD 0·96, SL 0·64, SI 53, PW 1·08, AL 1·60, MTL 0·67.

Occipital crest complete, shallowly concave, armed with denticles along its length; the denticles largest laterally, becoming gradually smaller towards the middle of the crest. Occipital corners each with a larger, slightly upcurved tooth. Eyes large; the sides of the head behind the eyes virtually without denticles. Edges of frontal carinae smooth, not jagged or crenulate. Sides of pronotum distinctly denticulate. Propodeum with a pair of short, narrow, acute spines. Petiole with dorsal surface convex, the subpetiolar process simple, subrectangular. First gastral tergite 1·83 long, 1·26 wide, marginate basally, this margination extending for a short distance on the sides of the sclerite.

Head reticulate-rugose with the cross-meshes incomplete in places and suppressed medially so that the rugae have a longitudinal trend, particularly in the middle of the dorsum. Pronotum with a coarse and disorganized rugoreticulum, but on the scutum and scutellum the rugae are longitudinal. On the propodeal dorsum two groups of rugae diverge from the anterior margin of the segment toward the spines and there is a subtriangular gap between the groups occupied by a few transverse rugae which continue on the declivity. First gastral tergite with some very fine meandering rugulae superimposed upon a fine, dense reticulate-puncturation.

Short, thick, hairs abundant, on the head some of these are gradually thickened from base to apex and appear clavate. Dorsal surfaces of middle and hind tibiae yellow, the ventral surfaces dark brown or black.

This species, known only from the type collection of a single female, is distinct from other members of the *granulatus*-group in a number of characters. It is distinguished from *simoni*, which it resembles most, by its larger size, more coarse sculpturation and lack of clavate hairs on the pronotum; and from other related species by the possession of a complete occipital crest, bicoloured tibiae, relatively narrow head and large eyes. The worker of this species may probably be similar to *setosus* but with relatively larger eyes, narrower head, more regular sculpturation and shorter propodeal spines.

The name *longinodus* is something of a misnomer for although the node is relatively longer and narrower than in *granulatus* it is by no means exceptional to the group as a whole. The petiole is in fact relatively shorter and broader than in queens of *simoni*.

Cataulacus marginatus sp. n.

(Text-fig. 38)

Holotype worker. TL 5·3, HL 1·24, HW 1·38, CI 111, EL 0·44, OI 32, IOD 1·08, SL 0·62, SI 45, PW 1·20, AL 1·42, MTL 0·70.

Occipital crest concave, the lateral portions better developed than the median which is represented only by a row of denticles. Lateral portions of the crest denticulate, as are the sides of the head behind the eyes. Occipital corners with a small, triangular tooth. Sides of frontal carinae irregular, especially on the posterior half, but their overall outline in full-face view is very weakly convex, and convergent anteriorly. Margins of pronotum, mesonotum and propodeum strongly denticulate, with a few denticles upon the outer margins of the propodeal spines. A small gap is present separating the denticles of the pro- and mesonotum and a larger, more obvious impression or notch occurs between mesonotum and propodeum. Propodeal spines with their bases widely separated, the spines themselves narrow, acute and each one shorter than half the basal distance separating it from its twin. Petiole in dorsal view massive, notably more so than the postpetiole, both segments broader than long. In profile the anterior, dorsal and posterior surfaces of the petiole form a more or less continuous convexity. Subpetiolar process simple, truncated basally. Sides of first gastral tergite very strongly marginate, the margins prominent.

Head reticulate-rugose, the interspaces shallowly reticulate-punctate and dully shining. Dorsum of alitrunk similarly sculptured, the points of intersection of the rugae raised into minute tubercles. Declivity of propodeum transversely rugose. Sculpturation of pedicel as alitrunk but coarser, first gastral tergite very finely reticulate-rugose with reticulate-punctate interspaces. Dorsal surfaces and lateral margins of head, body and appendages with numerous short, thick, blunt whitish hairs.

Paratype workers. TL 4·8 – 6·0, HL 1·16 – 1·32, HW 1·30 – 1·50, CI 112 – 114, EL 0·42 – 0·46, OI 31 – 32, IOD 1·02 – 1·14, SL 0·60 – 0·66, SI 43 – 46, PW 1·10 –1·30, AL 1·28 – 1·56, MTL 0·68 – 0·76 (9 measured).

As holotype but the sculpturation of the alitrunk somewhat variable. The rugae may tend to take on an apparently longitudinal direction due to the emphasis being placed on those rugae. The cross-meshes are reduced but not lost. In some the components of the rugoreticulum are rather more broad, flattened and less sharply defined than in others.

Holotype worker, CHINA: Hainan Is., grove near Hoi Man Chuen, S.W. of Nodoa, 4.vii.1929, Lingnan University 5th Hainan Is. expedition, 1929 (MCZ, Boston).

Paratypes. 4 workers, CHINA: Hainan Is., Ta Hau, 7.vii.1935 (*J. L. Gressitt*) (BMNH). 1 worker, same data as above but 4–5.vii.1935 (MCZ, Boston). 4 workers, CHINA: Hainan Is., Nodoa, 15–17.vii.1935 (*J. L. Gressitt*) (MCZ, Boston).

Extremely closely related to *granulatus*; separable from that species only by the possession of a very strongly marginate first gastral tergite. As *granulatus* itself occurs on Hainan Is. there is a possibility that *marginatus* is only a local population of that species and further collecting may show the two forms to be intergradient. It should be stressed that the gastral margination of the new species is very strongly developed and is visible to the naked eye, and this character serves easily to distinguish the two.

Cataulacus muticus Emery

Cataulacus muticus Emery, 1889 : 507, pl. 10, fig. 17. Holotype worker, BURMA: Tenasserim, Thagata, Mt. Mooleyit (*L. Fea*) (probably in MCSN, Genoa).

No specimens of this enigmatic species have been available for the present study. Apart from the type there is only one other collection referred to in the literature and that is the one reported by Bingham (1903 : 124) from the Ruby Mines district of Upper Burma, collected by Bingham himself and probably used as the basis of his description of the species. The notes on the characters of the species given below are thus culled from Bingham (1903) and Emery (1889) and from the figure of the dorsal alitrunk and pedicel appended to the latter publication.

Worker. TL 5·5 – ca 6·0. Head as in *granulatus* but proportionately larger and with the denticles of the sides of the head behind the eyes larger and more produced. Sides of pronotum and mesonotum strongly denticulate, but the sides of the propodeum with only one or two denticles and converging posteriorly. Propodeum with a pair of obtuse and blunt tubercles (referred to in Bingham as 'slightly produced rounded projecting laminae'). Petiole distinctly longer than broad, rather slender; postpetiole longitudinally oval, truncated in front and behind. Gaster as in *granulatus*. Head, alitrunk and pedicel very coarsely reticulate-rugose, the pedicel remarkably rugose. Gaster finely punctate and with fine longitudinal rugulae. Pilosity 'rather long', whitish in colour.

The overall picture which emerges is of a medium-sized species, definitely of the *granulatus*-group and seemingly closely related to *granulatus* itself, and yet distinguished by the presence of blunt propodeal tubercles instead of spines, the node of the petiole which is distinctly longer than broad, and the relatively smooth sides of the propodeum. Bingham, who was acquainted with *granulatus*, says that the head, alitrunk and pedicel of *muticus* were more coarsely sculptured than in any other species known to him.

Cataulacus nenassus sp. n.

(Text-fig. 41)

Holotype worker. TL 4·8, HL 1·16, HW 1·18, CI 101, EL 0·42, OI 35, IOD 0·90, SL 0·62, SI 53, PW 0·94, AL 1·30, MTL 0·61.

Occipital crest complete, shallowly concave in full-face view and denticulate throughout its length, the lateral denticles larger than those situated more mesad. Sides of head behind eyes denticulate, terminating in a small tooth at the occipital corners. Pronotal margins with four or five relatively large denticles and one or two smaller; mesonotal margins with two denticles, the sides of the propodeum and outer margins of the spines with numerous small or minute denticles. Propodeal spines long and strong, divergent, relatively close set basally. Petiole in profile with the anterior face steeply sloping, the dorsal and posterior faces continuous. First gastral tergite not marginate but with a few small denticles laterally towards the base.

Dorsum of head reticulate-rugose, the interspaces dully shining, finely and densely but shallowly reticulate-punctate. Dorsal alitrunk similarly sculptured but with the rather flattened longitudinal rugae tending to predominate. Propodeal declivity with a few faint, transverse rugae. Nodes of petiole and postpetiole similarly but rather more coarsely sculptured than the alitrunk, the points of intersection of the rugae raised into peaks (best seen in profile). First gastral tergite finely reticulate-punctate, with a fine but distinct, predominantly longitudinal rugulation covering the entire surface of the sclerite.

Short, erect, blunt hairs numerous upon all dorsal surfaces of the head and body, and also upon the appendages.

Paratype workers. TL 4·8 – 5·1, HL 1·16 – 1·20, HW 1·20 – 1·22, CI 100 – 105, EL 0·40 – 0·42, OI 32 – 35, IOD 0·90 – 0·92, SL 0·58 – 0·64, SI 48 – 53, PW 0·98 – 1·00, AL 1·30 – 1·36, MTL 0·60 – 0·66 (6 measured).

As holotype but with the number of large denticles on the pronotal margins variable, with a maximum of seven in the specimens available.

Paratype females. TL 5·8 – 6·2, HL 1·24 – 1·30, HW 1·24 – 1·30, CI 100, EL 0·44 – 0·46, OI 34 – 35, IOD 0·96 – 1·00, SL ca 0·68, SI 52 – 53, PW 1·10 – 1·19, AL 1·68 – 1·78, MTL 0·68 – 0·70 (5 measured).

As worker but with denticulation of occipital crest and sides of head behind eyes reduced. Sides of pronotum with four or five weak denticles; sides of propodeum irregular but not markedly denticulate. Propodeal spines shorter but distinct. Sculpturation of head, pronotum, pedicel and gaster similar to but rather more coarse than in the worker. Mesoscutum strongly longitudinally rugose, as is the propodeum. Scutellum similar but with some distinct cross-meshes, and without a transverse groove dividing it into anterior and posterior portions.

Paratype males. TL ca 5·2, HL 1·00 – 1·04, HW 1·02 – 1·10, CI 102 – 106, EL 0·40 – 0·42, OI 38 – 39, IOD 0·80 – 0·84, SL 0·62 – 0·64, SI 56 – 58, PW 0·92 – 0·98, AL 1·56 – 1·64 (2 measured).

Occipital crest complete and denticulate; sides of head behind eyes denticulate, terminating in a short, triangular tooth at the occipital corners. Sides of pronotum strongly marginate and denticulate. Sides of propodeum unarmed, the spines short but distinct. Anterior arms of notauli well developed and cross-ribbed, the posterior arm broad and shallowly demarcated. Head longitudinally rugose with a few cross-meshes, the rugae in one specimen tending to arch posteriorly and become transverse behind the ocelli. Pronotum sharply reticulate-rugose with punctate interspaces, as are the scutellum and propodeal dorsum, but the scutum is predominantly longitudinally rugose. Gaster very finely and faintly reticulate-punctate with numerous fine basigastric costulae, and some extremely fine longitudinal rugulae on the lateral portions of the tergite. All dorsal surfaces of head, body and appendages with numerous hairs.

Holotype worker, JAVA: Semarang, no. g45, 7.ii.1928 (*L. G. E. Kalshoven*) (MCZ, Boston).

Paratypes. 9 workers, same data as above; one pin, bearing three specimens, has a second label which repeats the data of the first and adds 'Teak Forest' (BMNH; MCZ, Boston; USNM, Washington). 6 alate females, same data as holotype (MCZ, Boston; BMNH). 1 alate female, 'Java zee', 11.ix.1920 (*Kl. Kombuis*) (MCZ, Boston). 2 males, same data as holotype (MCZ, Boston; BMNH).

This species is very closely related to *setosus* but may immediately be separated from it by the nature of the gastral sculpture in both worker and female. Also, in the *nenassus* worker the alitrunk is proportionately narrower and longer (width to length ratio 1 to 1·3 or 1·4) than in *setosus* which has a width to length ratio of about 1 to 1·1. The head is also narrower, the range of cephalic indices recorded in the type-series being 100–105 as compared to a range of 109–111 in *setosus* workers.

Apart from the fact that the species inhabits teak forests nothing is known of its biology.

Cataulacus setosus F. Smith

Cataulacus setosus F. Smith, 1860 : 114, pl. 1, fig. 7. Holotype worker, INDONESIA: Moluccas, Batjan (=Batchian) Island (*A. R. Wallace*) (UM, Oxford) [examined].

Worker. TL 4·1 – 4·2, HL 1·06 – 1·08, HW 1·16 – 1·20, CI 109 – 111, EL 0·40 – 0·42, OI 34 – 36, IOD 0·90 – 0·96, SL 0·58 – 0·62, SI 50 – 52, PW 0·92 – 1·07, AL 1·08 – 1·18, MTL 0·58 – 0·62 (5 measured).

Occipital crest complete, with denticles throughout its length. Sides of head behind eyes denticulate, the occipital corners with a small tooth which is, however, larger than either the denticles of the sides or of the occipital crest. Sides of pronotum marginate, the margins strongly denticulate. Sides of mesonotum and propodeum denticulate, the denticles extending onto the outer margins of the propodeal spines. Propodeal spines long, broad basally and tapering to an acute apex, each spine at least as long as half the distance separating it from its twin. Sides of first gastral tergite not margined but with a few small to minute denticles or prominences on the basal quarter of the sides when the gaster is examined in dorsal view.

Sculpturation of head and alitrunk coarse, conspicuous and somewhat variable. Dorsum of head posteriorly with a distinct rugoreticulum and with reticulate-punctate interspaces. Anteriorly the rugae tend to have a longitudinal direction, usually restricted to the area in front of the level of the anterior ocular margin although occasionally the rugoreticulum may extend almost to the clypeus. Pronotal dorsum strongly but rather loosely reticulate-rugose, the points of intersection of the rugae raised into small prominences; the interspaces reticulate-punctate. Mesonotal and propodeal dorsa sculptured as pronotum or with the sculpturation less intense, or with the rugae tending to assume a roughly longitudinal pattern. First gastral tergite densely and rather coarsely reticulate-punctate with fine longitudinal rugulae present basally and on the sides of the sclerite. The disc bears only the basic puncturation or has a few disorganized, short, broken rugulae.

Short, thick, blunt erect hairs numerous and conspicuous upon all dorsal surfaces of the head, body and appendages.

Female. TL 5·5 – 5·9, HL 1·22 – 1·26, HW 1·34, CI 106 – 109, EL 0·46 – 0·48, OI 34 – 36, IOD 1·06 – 1·08, SL 0·64 – 0·72, SI 48 – 54, PW 1·22 – 1·26, AL 1·68 – 1·76, MTL 0·72 – 0·74 (2 measured).

As worker but denticles on sides of head reduced, as are those on the sides of the alitrunk in dorsal view. Propodeal spines short and broad, acute. Sculpturation of head and pronotum as described above, but with the cephalic rugae having a more distinct longitudinal direction than in the worker. The mesothoracic sclerites and the propodeum are longitudinally rugose dorsally with the interspaces finely reticulate-punctate.

A member of the *granulatus*-group, *setosus* is separated from the majority of the species by its long propodeal spines, a character more in keeping with the species of the *taprobanae*-group. It is quickly distinguishable from *nenassus*, its closest relative, by the different gastral sculpturation in the latter, which has longitudinal rugulation over the entirety of the first tergite.

C. setosus represents the furthest known easterly penetration of the genus, being found on at least one island off the western extremity of New Guinea and possibly occurring on the mainland also.

MATERIAL EXAMINED.

PHILIPPINES: Mindanao Is., Davao (*C. F. Baker*); Mindanao (*A. M Moore*). MOLUCCAS: Batjan Is. (*F. Smith* coll.). NEW GUINEA: Waigeo Is., 2500 ft (*L. E. Cheesman*).

Cataulacus simoni Emery

(Text-fig. 40)

Cataulacus simoni Emery, 1893*a* : 248. Syntype workers, CEYLON: Kandy; Colombo, i.-ii.1892 (*E. Simon*) (probably in MCSN, Genoa).

Cataulacus granulatus race *andamanensis* Forel, 1903 : 406. Syntype workers, INDIA: Andaman Is. (MHN, Geneva) [examined]. **Syn. n.**

Worker. TL 3·8 – 4·1, HL 0·90 – 1·00, HW 0·90 – 1·04, CI 100 – 104, EL 0·36 – 0·40, OI 38 – 40, IOD 0·68 – 0·76. SL 0·48 – 0·50, SI 46 – 53, PW 0·72 – 0·80, AL 0·92 – 0·98, MTL 0·46 – 0·52 (6 measured).

Occipital crest complete or in some cases incomplete medially, armed with small denticles. Sides of head behind eyes minutely denticulate, terminating in a large denticle at the occipital corner. The head relatively long and narrow, with relatively large eyes. Lateral margins of alitrunk minutely denticulate along their length, the denticles spaced out and usually extending onto the lateral margins of the propodeal spines. Alitrunk broadest across the pronotum, the sides converging posteriorly in dorsal view; the alitrunk laterally without a pronounced U- or V-shaped notch or impression between the mesonotum and propodeum. Propodeal spines varying from a pair of distinct, relatively broad, short structures to a pair of small teeth. First gastral tergite not marginate laterally.

Head reticulate-rugose dorsally, the interspaces finely and quite feebly reticulate-punctate, dully shining. Pronotal dorsum reticulate-rugose, the points of intersection of the rugae often raised into minute peaks. On the mesonotum the rugae usually run longitudinally but in most specimens some feeble cross-meshes are visible which in some individuals may be strongly developed. Propodeal dorsum reticulate-rugose but more finely and densely so than the pronotum. The interspaces are always finely and weakly reticulate-punctate, dully shining. First gastral tergite reticulate-punctate with numerous weak longitudinal rugulae. The sides of the sclerite, above the tergosternal junction often have a number of coarse longitudinal rugae, but their development varies amongst individuals.

Dorsum of head with numerous short, distinctly and strongly clavate hairs which in some cases appear almost globular, with a short stem. Similar hairs are present upon the dorsal alitrunk but are more sparse, whilst upon the gaster the hairs are normal, short, thick, and blunt.

Female. TL 5·0, HL 1·02, HW 1·00, CI 98, EL 0·40, OI 40, IOD 0·78, SL 0·52, SI 52, PW 0·90, AL 1·40, MTL not measurable.

As worker but with reduced denticulation on the head and alitrunk. Propodeal spines proportionately smaller than in the worker, reduced to a pair of short, triangular teeth.

Sculpturation and form and distribution of hairs as worker, but the mesoscutum and scutellum longitudinally rugose, more regularly so upon the former than the latter where the rugae are somewhat sinuate. Gaster very much longer than broad, the first tergite 1·70 long and 1·04 wide at maximum in the female examined.

This small and quite distinctive species appears to be restricted to Ceylon and the Andaman Islands. The small size coupled with the relatively narrow head, large eyes and presence of clavate short hairs distinguishes the species from other members of the *granulatus*-group. The presence of clavate and subclavate hairs in some populations of *granulatus* from Java and the Andaman Islands is offset by size differences, differences in sculpturation, the presence of a constriction between mesonotum and propodeum and a marked difference in bodily build; *simoni* being a relatively slender species whilst *granulatus* is thick set and stocky.

Forel (1909*b* : 393) described the female and said that the gaster was twice longer than broad. Measurement of the female available for study showed that the gastral dimensions were not so extreme. The female is distinguished from that of *longinodus* by the presence of clavate hairs on the alitrunk, especially the pronotum, and its smaller size.

MATERIAL EXAMINED.

CEYLON: Laxapathiya, near Colombo (*K. L. A. Perera*); Peradenya (ex coll. *Donisthorpe*); Yakkala (*K. L. A Perera*); north Central Prov., Pollonaruwa (*K. L. A. Perera*).

THE *TAPROBANAE*-GROUP

The species of the *taprobanae*-group appear to have developed from a long-spined *granulatus*-like stock by the reduction of sculpture and reduction or complete loss of erect hairs from the dorsal surfaces of the body, particularly the head and alitrunk. The link between the two groups appears to be through *setosus* and *taprobanae*. In the last named species hairs are still relatively distinct, but in the closely allied *flagitiosus* they are very much reduced both in size and number. In *latus* some minute, flattened hairs may be present dorsally but in all other species they are completely lacking. Sculpturation is principally a fine, dense reticulate-puncturation which usually overlies any rugosity which may be present. A tendency of many species of the group is to replace the reticulate-rugulation of the mesonotum and propodeum by a regular series of low, longitudinal rugae which are more or less parallel. This is accomplished by the reduction or loss of the cross-meshes of the reticulum. In cases where this has occurred the resultant longitudinal rugae are very low and broad and their surfaces are covered by a dense reticulate-puncturation. Propodeal spines in all the species are well developed and relatively long and broad.

In the majority of species the occipital crest is well developed, although often not armed with denticles. The reduction in size and number of denticles on the crest and margins of the alitrunk appears to be correlated with the loss of erect hairs and reduction of the coarseness of the sculpturation in many species. Some species, especially those closest related to *reticulatus*, have the median portion

of the occipital crest produced into a rectangular ridge which is quite distinct in full-face view.

The distribution of the group extends eastwards from India to the Philippines and to Sulawesi. No species seem to be present east of these islands and, strangely, the group is not known from Java and is but poorly represented on Sumatra. The greatest number of species are found on Borneo, in the territories of East Malaysia.

Cataulacus catuvolcus sp. n.

(Text-figs 4, 37)

Holotype worker. TL 4·8, HL 1·12, HW 1·32, CI 118, EL 0·44, OI 33, IOD 1·04, SL 0·60, SI 45, PW 1·10, AL 1·20, MTL 0·64.

Occipital crest well developed, sharp, not denticulate, shallowly concave. Sides of head behind eyes weakly denticulate, terminating at the occipital corner in a small, triangular tooth. Margins of frontal carinae sinuate, not jagged nor denticulate, the preocular tooth low and very broad. Lateral margins of pronotum uneven, not denticulate but with four or five small prominences which give the margin a minutely wavy appearance. Margins of mesonotum unarmed, with a narrow but conspicuous notch between the mesonotum and propodeum which gives the latter a short, free anterior face on each side. Sides of propodeum and outer margins of the spines with a few small prominences, the spines themselves long, broad basally and tapering to an acute apex. Petiole subconical in profile, the anterior face sloping steeply backwards and meeting the confluent, sloping dorsal and posterior face in an acute angle. This angle is visible as a weak transverse ridge in dorsal view, with a short and steeply sloping face in front and a longer and more gradually sloping face behind. Sides of first gastral tergite marginate throughout their length.

Head and body everywhere finely and densely reticulate-punctate, this sculpturation overlying any rugation which is present. Dorsum of head with a fine, rather loose rugoreticulum, faint traces of which also occur on the pronotal dorsum. The remainder of the dorsal alitrunk is equipped with numerous low, rounded, regular and virtually parallel longitudinal rugae which do not extend onto the propodeal declivity. Dorsum of first gastral tergite with numerous short, faint longitudinal rugulae, more obvious towards the sides of the sclerite than on the disc.

Dorsal surfaces of head and alitrunk without erect hairs, but the margins of the frontal carinae and of the head behind the eyes support a row of laterally projecting, short hairs. Lateral margins of alitrunk with a few short, very small hairs. Dorsal surfaces of legs, postpetiole and posterior half of first gastral tergite with erect hairs, often minute.

Paratype workers. TL 4·2 – 4·8, HL 1·06 – 1·14, HW 1·26 – 1·32, CI 114 – 119, EL 0·42 – 0·46, OI 33 – 35, IOD 0·98 – 1·04, SL 0·54 – 0·60, SI 43 – 45, PW 0·98 – 1·10, AL 1·16 – 1·22, MTL 0·58 – 0·64 (7 measured).

As holotype but with the pronotal sculpturation somewhat variable. In most the rugoreticulum is more or less distinct, but the cross-meshes may be effaced or partially effaced, leaving the sclerite longitudinally sculptured as the remainder of the dorsal alitrunk. In many specimens the longitudinal rugae of the dorsum tend to continue for a short distance onto the propodeal declivity.

Paratype females. TL 5·1 – 6·0, HL 1·12 – 1·24, HW 1·30 – 1·40, CI 113 – 116, EL 0·44 – 0·48, OI 32 – 34, IOD 1·04 – 1·10, SL 0·56 – 0·60, SI 42 – 43, PW 1·18 – 1·30, AL 1·46 – 1·60, MTL 0·68 – 0·70 (3 measured).

As worker but denticulation of sides of head further reduced. Pronotum and propodeum constructed much as in worker but the spines of the latter proportionately shorter and broader. Lateral margination of the first gastral tergite absent or with the side portions of the sclerite meeting the dorsum in an obtuse angle. Sculpturation of head as in worker, pronotum longitudinally rugose with some reticulation at the sides. Mesoscutum with a faint, regular, more

or less parallel longitudinal rugulation. The rest of the alitrunk similarly but more coarsely sculptured, usually with some weak cross-meshes on the scutellum and with the rugae diverging on the propodeum.

Paratype males. TL ca 5·1, HL 0·84 – 0·90, HW 1·06 – 1·10, CI 118 – 130, EL 0·40 – 0·42, OI 36 – 40, IOD 0·82 – 0·88, SL 0·50 – 0·52, SI ca 47, PW 0·90 – 0·98, AL 1·36 – 1·50, MTL 0·66 – 0·70 (2 measured).

Occipital crest sharp and distinct, unarmed. Sides of head behind eyes denticulate, the occipital corners with a small tooth. Frontal groove visible as a polished strip of cuticle, not reaching the median ocellus. Sides of pronotum and propodeum irregular but without denticles; propodeal spines strongly developed, broad and acute. Notauli almost or quite absent. In the larger specimen the path of the anterior arms is visible, but in the smaller only a very weak indentation marks their former position; the posterior arm is not developed. Sides of first gastral tergite marginate for about two thirds of their length, the margination most distinct anteriorly, gradually fading out behind. Sculpturation of dorsal surfaces of head and alitrunk a fine rugoreticulum with punctate interspaces, the rugae tending to have a longitudinal direction on the scutum. Gaster and the strongly sclerotized apical portions of the parameres finely reticulate-punctate.

Holotype worker, PHILIPPINES: Romblon Island, 2.v.1924 (*J. W. Chapman*) (MCZ, Boston).

Paratypes. 8 workers, 3 alate females (one with gaster missing) and 2 males, with same data as holotype (MCZ, Boston; BMNH).

The species belongs to the small complex in the *taprobanae*-group centring on *reticulatus*. It is distinguishable from *reticulatus* and its immediate allies by the combined presence of a sharp occipital crest which is not raised medially, a marginate first gastral tergite, and by the form of the sculpturation upon the dorsal alitrunk.

The type-series is from Romblon Is. but it seems that the species is also present upon Luzon as a damaged male from Benguet, Luzon Is. collected by C. F. Baker is almost certainly referable to this species.

Cataulacus chapmani sp. n.

(Text-fig. 30)

Holotype worker. TL 4·9, HL 1·14, HW 1·34, CI 118, EL 0·42, OI 31, IOD 1·08, SL 0·60, SI 45, PW 1·06, AL 1·34, MTL 0·66.

Occipital crest absent, the vertex not separated from the occiput. Sides of head behind eyes denticulate, the occipital corners with a small, broad but low triangular tooth. Margins of frontal carinae arcuate, not crenulate nor denticulate; preocular tooth small and very broad basally. Margins of alitrunk not denticulate except for a single very small prominence upon the outer margin of each propodeal spine, on its apical half. Mesonotum separated from propodeum by a narrow but distinct notch or constriction. Propodeal spines long, tapering and acute apically. Petiole in profile with the steeply back-sloping anterior face meeting the sloping dorso-posterior face in an acute angle which is visible as a transverse ridge in dorsal view. Sides of first gastral tergite not marginate.

Sculpturation of a fine dense reticulate-puncturation everywhere which overlies any rugulation which may be present. Head finely reticulate-rugose, the cross-meshes tending to fade out in front of the level of the anterior margins of the eyes so that only the longitudinal component remains. Dorsum of pronotum reticulate-rugose but the remainder of the dorsal alitrunk with only fine, low, regular and more or less parallel longitudinal rugae. Upper part of propodeal

declivity between the spines with one or two weak, transverse rugae, the remainder reticulate-punctate only. First gastral tergite with a very close and fine reticulate-puncturation and numerous short, irregular longitudinal rugulae.

Dorsal surfaces of head and alitrunk without erect hairs but the margins of the former with some minute hairs projecting laterally. Margins of alitrunk also with a few minute, projecting hairs. Dorsal surfaces of legs and gaster with scattered small hairs, best seen on the apical third of the latter.

Paratype workers. TL 4·4 – 4·8, HL 1·04 – 1·16, HW 1·26 – 1·36, CI 117 – 121, EL 0·40 – 0·42, OI 30 – 32, IOD 1·02 – 1·10, SL 0·56 – 0·60, SI 44 – 45, PW 1·00 – 1·10, AL 1·20 – 1·38, MTL 0·60 – 0·68 (10 measured).

As holotype but some show the development of two or three low, blunt denticles upon the pronotal margin. In one of the smaller specimens erect hairs are completely absent from the first gastral tergite and the transverse rugae of the upper portion of the propodeal declivity may be very faint or even absent.

Paratype males. TL 4·6 – 4·8, HL 0·96 – 1·00, HW 1·14 – 1·16, CI 116 – 119, EL 0·38 – 0·40, OI 33 – 35, IOD 0·94 – 0·98, SL ca 0·54, SI 46 – 47, PW 0·96 – 0·98, AL 1·52 – 1·60, MTL ca 0·70 (2 measured).

Occipital crest absent, sides of head behind eyes denticulate. Occipital corners with a well developed, broadly triangular tooth. Frontal groove indistinct, not reaching the median ocellus. Margins of pronotum and propodeum irregular but not denticulate, the propodeal spines very short and broad, blunt apically. Notauli completely absent or with a very weak impression marking the position of the anterior arms. First gastral tergite not marginate laterally. Head finely reticulate-rugose, the interspaces reticulate-punctate, and with the cross-meshes tending to disappear in front of the level of the eyes so that only the longitudinal component remains. Dorsal surfaces of pronotum and propodeum and the scutellum reticulate-rugose and punctate, the scutum more definitely longitudinally rugose but with some feeble cross-meshes. Gaster and the apical portions of the parameres finely and densely reticulate-punctate. Distribution of hairs as in worker.

Holotype worker, PHILIPPINES: Negros Island, Dumaguete, 30.iv.1924 (*J. W. Chapman*) (MCZ, Boston).

Paratypes. 14 workers, same data as holotype (MCZ, Boston; BMNH; USNM, Washington). 2 males, same data as holotype but without date of collection and stating '500 ft' (MCZ, Boston). 1 worker, same locality and collector as holotype but dated 28.iv.32 (MCZ, Boston). 1 worker and 1 male, same data as holotype but undated and bearing the number '405' (BMNH). 1 worker, PHILIPPINES: Luzon Island, Lamao, no further data (MCZ, Boston).

Closely related to *reticulatus* and its immediate allies, *chapmani* is separated by its lack of an occipital crest, which is present in other species of the complex. The sculpturation of the alitrunk approximates closely to that of *catuvolcus* but this species has a marginate first gastral tergite as well as a distinct occipital crest.

Cataulacus flagitiosus F. Smith

(Text-figs 31, 34)

Cataulacus flagitiosus F. Smith, 1862 : 49. Holotype worker, SULAWESI: Tondano (*A. R. Wallace*) (UM, Oxford) [examined].

Worker. TL 4·6 – 4·8, HL 1·10 – 1·12, HW 1·30 – 1·34, CI 116 – 122, EL 0·40 – 0·42, OI 29 – 32, IOD 0·98, SL 0·62, SI 46 – 47, PW 1·12 – 1·20, AL 1·28 – 1·33, MTL 0·65 – 0·68 (2 measured).

Sides of head behind eyes denticulate, the occipital corner with a subtriangular tooth. Occipital crest complete, with a relatively large first (outer) denticle, mesad of which is a small gap followed by a row of minute denticles which are situated upon a long and very low median projection of the margin, similar to that seen in *reticulatus* but much reduced. Pronotum on each side with the lateral margination extended as a broad flange, denticulate on its outer edges and notably broader than the part of the pronotum in front of it or the mesonotum behind. Sides of mesonotum and propodeum not marginate, without denticles. In profile the promesonotum forming an even convexity which meets the dorsal surface of the propodeum in a short but distinct step, the propodeal dorsum being on a lower level than that of the promesonotum. Propodeal spines long, strong and divergent, each as long as the complete distance separating it from its twin; the outer margins of the spines not denticulate. Base of gaster marginate, the margination continued onto the sides but fading out posteriorly.

Dorsum of head with a coarse but somewhat effaced rugoreticulum which shows a longitudinal direction, particularly on the median portion; the whole overlaid by a fine and dense reticulate-puncturation. Alitrunk similarly sculptured dorsally, the rugoreticulum distinct only upon the pronotum, grading out posteriorly to a series of faint, regular longitudinal rugae which traverse the mesonotum. Propodeal dorsum with a faint rugoreticulum; the whole alitrunk covered with a fine dense reticulate-puncturation. Propodeal declivity with a few transverse rugae. First gastral tergite with irregular and often broken longitudinal rugulae and a dense reticulate-puncturation.

Dorsa of head, alitrunk and gaster with a few scattered, very short, thick hairs; the margins of these regions with small hairs which project laterally.

Known only from Sulawesi, this species has been recorded in the literature on two occasions; the type collection from Tondano and two collections made by Beccari at Makasar and Kandari, reported by Emery (1887 : 470). The species is characterized by the presence of prominent pronotal lobes or flanges; nothing is known of its biology.

Cataulacus latissimus Emery

(Text-fig. 28)

Cataulacus latissimus Emery, 1893*b* : 215, pl. 8, fig. 10. Syntype workers, West Malaysia: Perak (*Bedot & Pictet*) (probably in MCSN, Genoa).

Cataulacus latissimus var. *mimula* Menozzi, 1923 : 210. Syntype workers, Borneo: Brunei (*Staudinger & Bang-Haas*) (probably in IE, Bologna). **Syn. n.**

Worker. TL 6·0 – 8·0, HL 1·50 – 1·64, HW 2·16 – 2·40, CI 144 – 146, EL 0·48 – 0·54, OI 22 – 23, OID 1·76 – 1·90, SL 0·86, SI ca 36, PW 1·86 – 2·20, AL 1·60 – 1·98, MTL ca 1·02 (2 measured).

Head massive, obviously much broader than long, the eyes relatively small. Occipital crest complete, sinuate with the median portion concave, and with a series of denticles along its length. Sides of head behind eyes denticulate and terminating in a subtriangular tooth at the occipital corners. Pronotum very broad, margined anteriorly by a small, raised ridge and laterally by a pair of large, flange-like expansions, the borders of which are denticulate. Mesonotum laterally with an apically bifurcate tubercle. Propodeum and basal half of the spines expanded laterally, the expanded portion denticulate along the edges. The apical halves of the spines smooth and tapering to an acute point. Promesonotal suture effaced, but its track marked by a very poorly defined impression in large workers. Also in larger workers the path of the metanotal groove may be picked out by a strip of more polished cuticle. First gastral tergite marginate around the entire circumference, strongest anteriorly and anterolaterally, less strong but still distinct elsewhere.

Sculpturation of head a fine and dense rugoreticulum with reticulate-punctate interspaces, the rugae tending to fade out anteriorly. Sculpturation of alitrunk and gaster similar to that of head, with the rugulae of the pronotum and first gastral tergite finer than those of the remainder of the alitrunk or pedicel.

Hairs absent from dorsal surfaces of head, alitrunk and gaster but present on the pedicel and around the margins of the aforementioned areas, and also upon the appendages.

Putative male. TL 7·2, HL 1·36, HW 1·74, CI 128, EL 0·48, OI 28, IOD 1·46, SL 0·80, SI 46, PW 1·54, AL 2·21 .

Occipital crest complete, shaped and armed as in the worker. Sides of head behind eyes denticulate, without a separate larger tooth at the occipital corner. Head distinctly broader than long, the eyes relatively larger than in the worker. Pronotum expanded laterally into a rounded flange on each side, the margins of which are denticulate and distinctly overhang the lateral portions of the sclerite. Anterior margin of pronotum with a low, transverse ridge which is broken medially. Anterior arms of notauli well developed and cross-ribbed, the posterior arm represented by a broad and shallow longitudinal groove. Parapsidal furrows present on the posterior half of the scutum. Propodeal spines distinct, short and broad. Gaster marginate laterally to the level of the spiracle of the first tergite, behind which it fades out. Spiracle of the first tergite borne upon a small tubercle, and the edge of the gaster between this and the base with two or three small denticles.

Head finely reticulate-rugose, more finely so on the anterior half where the cross-meshes are largely incomplete or absent and the rugae more or less longitudinal. Some broader, coarser rugae originate at the inner margin of each eye and run posteromedially to the occipital crest. Interspaces of the rugoreticulum finely and densely reticulate-punctate. Alitrunk with a rugoreticulum over the entire dorsum, finest on the pronotum, considerably more coarse on the propodeum and with reticulate-punctate interspaces. First gastral tergite with some basigastric costulae and a few weak, broken longitudinal rugae which do not extend onto the posterior half of the segment. Otherwise the gaster entirely reticulate-punctate. All dorsal surfaces of the head, body and appendages with erect, stout hairs.

By virtue of its large size, extremely broad head, laterally expanded pronotum, strongly marginate gaster and lack of hairs upon the dorsal surfaces of the head and body, the worker of this species is unlikely to be confused with any other. Menozzi's variety *mimula* shows only slight differences in sculpturation and is stated to be somewhat larger than the type, but the length given falls within the range quoted for workers, above. The range of the species includes East and West Malaysia and Singapore. It has also been recorded from Sumatra by Forel (1912 : 69).

MATERIAL EXAMINED.

SINGAPORE: (*Baker*). BORNEO: Kuching (*J. Hewitt*); Sandakan (*Baker*).

Cataulacus latus Forel

(Text-fig. 2)

Cataulacus latus Forel, 1891*a* : 144. Syntype males, INDIA: Poona, 16.vi.1890 (*R. C. Wroughton*) (MHN, Geneva) [examined].

Note on the types. Although Forel only made mention of the male in his original description of this species, the type-series (in MHN, Geneva) also includes three females with the same data as the males. These males and females bear a red

'typus' label and this is most probably the series referred to by Wroughton (1892 : 178) as '120. *Cat. latus* (Forel MS). Poona Dists. 14.6.90, worker, male, female'. The workers from this series appear to be lost and there is a two day discrepancy in the data label date on the specimens from that given by Wroughton. However, this must be considered as the complete type-series.

Bearing yellow 'cotypus' labels are three females and three workers from Kanara, LVI/6 (*Wroughton*) and three more males from Poona (*Wroughton*). Three more workers from this Kanara series are in USNM, Washington bearing a red 'cotype' label and a note stating 'not a type?' signed M.R.S. (M. R. Smith?). These specimens from series LVI/6 are not types, in any sense of the word.

Worker. TL 5·4 – 7·5, HL 1·38 – 1·74, HW 1·66 – 2·23, CI 120 – 131, EL 0·36 – 0·46, OI 19 – 22, SL 0·68 – 0·82, SI 37 – 41, IOD 1·36 – 1·82, PW 1·28 – 1·86, AL 1·42 – 2·00, MTL 0·90 – 1·18 (10 measured).

Frontal groove usually distinct from the apex of the frontal triangle to the level of the anterior margins of the eyes, its track marked by an impression or a polished strip of cuticle. Occipital crest marked out by a row of denticles of which the first (outer) is the largest, often as large as the denticle at the occipital corner. The crest is usually incomplete medially, and this gap appears to be relatively broader in smaller individuals than in larger ones. Sides of head behind eyes denticulate. Eyes relatively small; ocelli usually absent but one or two may be developed. Lateral margins of pronotum denticulate, also with one or two denticles on the mesonotal and propodeal margins and on the outer edges of the propodeal spines. A break in denticulation coupled with a V- or U-shaped impression is present between pro- and mesonotum and the latter and the propodeum in dorsal view. Propodeal spines well developed. Gaster not marginate laterally.

Sculpturation of head basically a fine, dense reticulate-puncturation with scattered larger punctures distributed over the frons and vertex. Behind the eye and between it and the occipital corner a fine rugoreticulum is present. Dorsum of alitrunk finely longitudinally rugose or reticulate-rugose, with an overlying fine, dense reticulate-puncturation. Gaster finely and densely reticulate-punctate with numerous very fine, broken longitudinal rugulae.

Dorsal surfaces of head and alitrunk without hairs or (usually) with a few minute, flattened hairs, not easily seen. Lateral margins of head and alitrunk with short, blunt hairs, also present on the pedicel, gaster and appendages.

Female. TL 9·2 – 10·4, HL 1·84, – 1·90, HW 2·10 – 2·20, CI 110 – 119, EL 0·46 – 0·50, OI 21 – 24, IOD 1·74 – 1·82, SL ca 0·84, SI ca 39, PW 1·90 – 2·04, AL 2·60 – 2·84, MTL 1·16 – 1·23 (6 measured).

Similar to worker but with the frontal groove better developed, usually distinct to the level of the anterior ocellus. Denticles of the occipital crest indistinct except for the first (outermost) in the series on each side; the denticles of the sides of the head behind the eyes very much reduced or absent. Sculpturation of head as worker but with distinct rugae behind the eyes. Mesoscutum and scutellum with rather coarse but flattened longitudinal rugae overlaid with a fine, dense reticulate-puncturation. Propodeal spines much reduced. Arrangement of hairs similar to worker but the dorsum of the pronotum with short hairs present, particularly in a transverse row just anterior to the promesonotal suture.

Male. TL 6·0 – 7·0, HL 1·14 – 1·26, HW 1·34 – 1·60, CI 117 – 131, EL 0·40 – 0·44, OI 26 – 29, IOD 1·16 – 1·30, SL 0·68 – 0·76, SI 45 – 50, PW 1·22 – 1·45, AL 1·84 – 2·14 (3 measured).

Frontal groove distinct as strip of polished cuticle running from the apex of the frontal triangle to the anterior (median) ocellus. Sides of head behind eyes denticulate, terminating in a larger tooth at the occipital corner. Mesad of this lie the denticles marking the occipital crest, the first being distinctly the largest of the series. Anterior arms of notauli distinct, with coarse cross-ribs, the spaces between which are shiny. Posterior arm less well developed. Parapsidal

furrows present on the posterior half of the sclerite as polished strips of cuticle. Margins of pronotum jagged; propodeal spines absent, replaced by a pair of acute angles. Dorsum of head, alitrunk and petiole with a fine rugoreticulum, the interspaces sharply and densely reticulate-punctate; the rugoreticulum best defined on the head, propodeum and petiole, less distinct on the thorax proper. Gaster finely and densely reticulate-punctate with a few radiating basigastric costulae. Parameres dorsoventrally flattened, the exposed portions smooth and shiny. Dorsal surfaces of head, alitrunk and gaster equipped with erect hairs.

The large size, relatively small eyes and broad head serve to distinguish this species from others of the *taprobanae*-group. It also differs by the presence of a frontal groove and is separable from its closest relative, *latissimus*, by the absence of gastral margination and flange-like lateral expansions of the pronotum. Apparently all that is known of the biology of this interesting species is the report of Wroughton (1892) that the species nests in hollow tree branches and that the nest which he examined contained 'the pupae of some kind of *Lycaena* (?)' which he was unable to rear through to the imago.

MATERIAL EXAMINED.

INDIA: Travancore, Tenmalai (?); no data (ex coll. *Forel*); Bengal, Orissa (*Taylor*); Bengal, Pusa (*G. D. R.*); Kerala State, Nilambur (*A. B. Soans & W. L. Brown*); no data (*G. B. King*); Poona (*Wroughton*); South Mysore (*H. L. Andrews*); Haldwani Dist., Kumaon (*H. G. Champion*); Savantvadi State (*J. C. Bridwell*); Bombay (*J. C. Bridwell*). BURMA: Pegu (ex coll. *Bingham*).

Cataulacus praetextus F. Smith

(Text-fig. 36)

Cataulacus praetextus F. Smith, 1867 : 528, pl. 26, fig. 5. Holotype worker, BORNEO (UM, Oxford) [examined].

Cataulacus praetextus var. *sumatrensis* Forel, 1912 : 60. Holotype worker, SUMATRA: Indrapura (*Tritschler*) (MHN, Geneva) [examined]. **Syn. n.**

Worker. TL 5·2 – 6·0, HL 0·90 – 1·04, HW 0·94 – 1·10, CI 104 – 106, EL 0·36 – 0·40, OI 36 – 38, IOD 0·72 – 0·80, SL 0·48 – 0·52, SI 47 – 51, PW 0·76 – 0·92, AL ca 1·00, MTL 0·48 – 0·52 (2 measured).

Occipital crest complete, the median portion raised into a low, projecting ridge in full-face view; entirety of crest without denticles. Sides of head behind eyes denticulate, sometimes not very distinctly so, the occipital corners with a low, broad, triangular tooth. Sides of pronotum with a rectangular shallow expansion, the margins of which have one or two feeble teeth or crenulations anteriorly. Sides of mesonotum roughly triangular in dorsal view, with a distinct U- or V-shaped notch or impression separating them from the propodeum. Propodeum behind this notch with a short free anterior face. Sides of propodeum marginate, continuous with the sides of the spines, the margins with three to five denticles. First gastral tergite marginate laterally throughout its length, the margination most distinct basally.

Dorsal surfaces of head and alitrunk with a fine rugoreticulum with the interspaces finely and densely reticulate-punctate. The sculpturation has approximately the same intensity on all parts of the dorsal alitrunk. Dorsal surfaces of pedicel similarly but more loosely sculptured;

the first gastral tergite finely and very densely reticulate-punctate with numerous short rugulae, the majority of which are longitudinal.

Dorsal surfaces of head, alitrunk and first gastral tergite without hairs. Hairs are, however, present on the mandibles and a row of short, flattened hairs adorns the margin of each frontal carina. Sides of head behind eyes with a row of very short, flattened hairs which project beyond the lateral margins in full-face view. Lateral margins of alitrunk with a few similar hairs. Dorsal surfaces of femora and tibiae without hairs except for one or two which may be present at the extreme apices of the latter.

Putative female. TL 5·2 – 6·0, HL 1·04 – 1·14, HW 1·14 – 1·30, CI 109– 114, EL 0·40 – 0·44, OI 35, IOD 0·82 – 0·94, PW 1·02 – 1·16 (2 measured).

Similar to worker, the median projecting portion of the occipital crest distinct. Denticulation of sides of head behind eyes less well developed; the expansions of the sides of the pronotum much reduced, with a small but distinct triangular tooth at the beginning of the lateral margination on each side. Propodeal spines smaller than in worker, the sides of the first gastral tergite not marginate. Sculpturation of head, pronotal dorsum, propodeum, pedicel and first gastral tergite as worker but the scutum and scutellum longitudinally rugose, the spaces between the rugae finely reticulate-punctate. Hairs distributed as in worker but one or two erect hairs may be present on the femora.

Putative male. TL 4·8 – 5·2, HL 0·86 – 0·88, HW 1·02 – 1·06, CI 118 – 120, EL 0·36 – 0·38, OI 34 – 37, IOD 0·78 – 0·84, SL ca 0·50, SI 47 – 49, PW 0·96 – 1·00, AL 1·56 – 1·61, MTL ca 0·72 (4 measured).

Occipital crest complete, unarmed, the median portion raised and projecting as in the worker. Sides of head behind eyes not denticulate, usually feebly sinuate. Occipital corners in the form of projecting, broad, triangular angles. Frontal groove distinct, not reaching the median ocellus. Sides of pronotum not expanded, without denticles. Anterior arms of notauli distinct at least anteriorly and with cross-ribs, the posterior arm indistinct or absent. Parapsidal furrows present. Propodeal spines broad basally, rapidly converging to an acute apex. First gastral tergite not marginate. Parameres in side view with a strong, thick brush of hairs ventrally.

Sculpturation somewhat variable. Head usually reticulate-punctate everywhere with a superimposed fine rugoreticulum posteriorly on the dorsum and fine, more definitely longitudinally directed rugulae anteriorly, the change in sculpturation taking place more or less at the level of the median ocellus. On the most finely sculptured individuals the rugulae are virtually absent from the anterior half of the head. Dorsum of alitrunk reticulate-punctate with sparse longitudinal rugulation on the mesonotal sclerites and a fine rugoreticulum upon the propodeum. Gaster very finely reticulate-punctate and dully shining. Erect hairs sparse everywhere but the second to fifth gastral tergites inclusive with a transverse row of many long, thick, blunt hairs, entirely absent from the first tergite.

Forel's variety *sumatrensis* is a very ordinary example of the worker of *praetextus*, without notable differences from the type of the species. *C. praetextus* is distinguished from its immediate congeners by the form of sculpturation, great reduction of hairs, especially on the legs, the laterally marginate first gastral tergite and the projection of the occipital crest. It appears to be closest related to *reticulatus* and *catuvolcus*. The male is distinguished by the rather odd bands of long thick hairs on each visible gastral tergite behind the first.

MATERIAL EXAMINED.

WEST MALAYSIA: Selangor, Gombak (?). BORNEO: Mt. Tobangs, 1700 m (*E. Mjoberg*); Mt. Dulit, 3000 ft (*E. Mjoberg*); Kuching (*J. Hewitt*).

Cataulacus reticulatus F. Smith

(Text-fig. 35)

Cataulacus reticulatus F. Smith, 1857 : 81, pl. 2, fig. 8. Holotype worker, BORNEO: Sarawak (*A. R. Wallace*) (UM, Oxford) [examined].

Cataulacus reticulatus var. *minor* F. Smith, 1857 : 81. Holotype worker, BORNEO: Sarawak (*A. R. Wallace*) (presumed lost). **Syn. n.**

Redescription of holotype worker. TL 4·2, HL 1·06, HW 1·26, CI 119, EL 0·40, OI 32, IOD 0·92, SL 0·54, SI 43, PW 0·98, AL not measurable, MTL 0·60

Occipital crest complete, the median portion raised into a low, posteriorly projecting ridge; the crest without denticles. Sides of head behind eyes crenulate-denticulate, terminating in a small triangular tooth at the occipital corners. Preocular tooth triangular, the frontal carinae in front of this at first shallowly concave, then convex over the antennal insertions. Frontal groove absent. Sides of pronotum with a marginate, subrectangular expansion which begins a short distance behind the anterior pronotal border. Sides of mesonotum convex, angular, separated from the propodeum by a distinct V-shaped impression. Propodeum behind this notch with a free anterior margin at each side, the lateral margins extremely shallowly concave and continuous with the outer margins of the spines. Propodeal spines long, well developed, broad at the base and tapering to an acute apex. Lateral borders of all constituents of the alitrunk neither crenulate nor denticulate; the dorsum devoid of sutures or sutural impressions. Petiole in profile with the anterior and posterior faces sloping and convergent dorsally so that there is no separated dorsal surface to the segment. Dorsum of postpetiole low and rounded. Subpetiolar process simple, with an acute posteroventral angle. Subpostpetiolar process low and subrectangular. First gastral tergite longer than broad, length ca 1·50, maximum width ca 1·28, the sides convex and narrowing posteriorly. Basal corners marginate, the margination scarcely extending onto the sides.

Entirety of dorsum of head and alitrunk with a fine rugoreticulum, the interspaces of which are finely and densely reticulate-punctate. First gastral tergite similarly but much more finely sculptured. Propodeal declivity predominantly reticulate-punctate with only a few very faint rugulae; the anterior face of the petiole similarly sculptured.

Erect hairs virtually absent, present only on the mandibles and antennal scapes. A few (four or five) very short, blunt hairs project beyond the margins of the frontal carinae in dorsal view; otherwise the margins of the head and alitrunk are without projecting hairs although one or two minute, flattened hairs may be present near the margins themselves. First gastral tergite without hairs; some are present on the sternites.

Emery (1889 : 507) suggested that *reticulatus* was not specifically different from *granulatus* and this view was endorsed in the catalogue of Dalla Torre (1893) who gave the former as a synonym of the latter name. There the situation rested until Donisthorpe (1932) overhauled the types created by F. Smith from the collections of A. R. Wallace. Donisthorpe re-examined the type of *reticulatus* and declared it a good species. Unfortunately he did not characterize the species and so up to the present time the only description available has been the unworkable original and the rather poor figure which accompanies it. The var. *minor* appears to have come from the same series as the type and was separated from it only by minor details of colouration, which make one suspect it of being merely a teneral form.

The true affinity of the species does not lie with *granulatus* but with the species of the *taprobanae*-group, particularly with *praetextus*, *catuvolcus* and *chapmani*, from which it is separable by the characters given in the key.

Cataulacus taprobanae F. Smith

(Text-figs 32, 33)

Cataulacus taprobanae F. Smith, 1853 : 225, pl. 20, fig. 10. Holotype worker, CEYLON: (*G. H. K. Thwaites*) (BMNH) [examined].

Worker. TL 4·1 – 5·4, HL 1·02 – 1·32, HW 1·26 – 1·50, CI 112 – 123, EL 0·42 – 0·48, OI 32 – 33, IOD 0·96 – 1·20, SL 0·54 – 0·70, SI 41 – 47, PW 1·02 – 1·32, AL 1·22 – 1·54, MTL 0·64 – 0·82 (10 measured).

Occipital crest complete or broken but always marked out by a series of denticles which decrease in size medially; those nearest the centre often minute. The crest itself shallowly concave across the width of the head. Sides of head behind eyes denticulate, the occipital corners with a small tooth which is, however, larger than the first denticle of the occipital crest. Sides of pronotum marginate, denticulate, but the sides of the mesonotum weakly or not marginate, with only one or two very small denticles. Propodeal spines long, stout and acute, divergent, the outer margins of the spines and the sides of the propodeum with a few minute denticles. First gastral tergite not marginate laterally.

Sculpturation of head and alitrunk primarily of a fine and dense reticulate-puncturation which overlies any rugulation present. The head with a fine loose rugoreticulum or with longitudinal rugae. Pronotum feebly reticulate-rugose, with the rugae tending to become longitudinal and less distinct posteriorly so that on the mesonotum the sculpturation is dominated by the puncturation and only a few feeble longitudinal rugulae are visible. Propodeum sculptured as mesonotum, the declivity usually with a few transverse rugae. First gastral tergite strongly reticulate-punctate with numerous weak longitudinal rugulae.

Dorsal surfaces of head, pedicel, first gastral tergite and appendages with numerous short, stout hairs, also present around the margins of the head and pronotum. Dorsum of alitrunk with a few scattered hairs only.

Female. TL 6·8 – 7·0, HL 1·40 – 1·44, HW 1·48 – 1·58, CI 105 – 109, EL 0·48 – 0·50, OI 32, IOD 1·24 – 1·40, SL ca 0·72, SI ca 45, PW 1·44 – 1·48, AL 1·96 – 1·98, MTL 0·82 – 0·86 (3 measured).

Similar to worker but occipital crest incomplete medially, the median section broadly concave. Denticulation of crest and the sides of the head much reduced. Sides of pronotum with a few small denticles, the sides of the propodeum irregular but not denticulate. Propodeal spines a pair of short, broad, triangular teeth. Sculpturation basically as in worker but with the rugoreticulum of the head and pronotum more pronounced, the scutum and scutellum longitudinally and quite regularly rugose. Distribution of hairs as in worker but those on the head are shorter and less distinct. A transverse row of short hairs is present on the pronotum just anterior to the promesonotal suture.

Male. TL 5·0 – 5·4, HL 1·04 – 1·12, HW 1·18 – 1·26, CI 111 – 117, EL 0·42 – 0·44, OI 34 – 35, IOD 0·98 – 1·04, SL 0·62 – 0·68, SI 49 – 54, PW 1·10 – 1·38, AL 1·72 – 1·82, MTL 0·80 – 0·84 (3 measured).

Occipital crest shallowly concave, usually complete but broken medially in some individuals. The crest denticulate, very feebly so medially, the largest denticles being those closest to the short, triangular occipital tooth. Sides of head behind eyes denticulate. Sides of pronotum irregular but not definitely denticulate. Notauli with only the anterior arms developed, and usually only the distal portions distinct and cross-ribbed; the posterior arm absent. Parapsidal furrows present. Propodeum with a pair of short but acute projecting teeth. Apical portions of parameres smooth and shining. Head and pronotum loosely reticulate-rugose, the rugae of the former raised into minute peaks at many of the points of intersection. Reticular interspaces finely and densely reticulate-punctate. Mesoscutum and scutellum finely longitudinally rugose, the gaster finely and densely reticulate-punctate with some basigastric costulae present. Hairs numerous on all dorsal surfaces, much more conspicuous than in the other castes.

One of the relatively few species to inhabit the Indian subcontinent, *taprobanae* is distinguished by its long, divergent propodeal spines, reduced sculpturation dominated by puncturation and the presence of short, erect hairs on the alitrunk. Bingham (1903 : 121) states that he always found the species on the bark or leaves of trees 'wandering about apparently in an aimless sort of way.' The female of the species was originally described by Forel (1909*b* : 393).

MATERIAL EXAMINED.

INDIA: Walajanagar (*A. P. Nathnu*); Kerala State, Kottiyoor, Wynaad Taluk (*A. B. Soans* and *W. L. Brown*); Kerala State, Cannanore Distr., Kannoth (*A. B. Soans* and *W. L. Brown*); Travancore, Tenmalai (?); Madras, Nilgiris Dist., 3,500 ft (ex coll. *Donisthorpe*); Savantvadi State (*J. C. Bridwell*); Goa, Moramuga (*J. C. Bridwell*); Mangalore (*J. C. Bridwell*). CEYLON: Kandy (*Bingham*); N. Centr. Prov., Pollonaruwa (*K. L. A. Perera*); Gilimale, near Ratnapura (*E. O. Wilson*); Sawaragomuwa Prov., Belihulaya (*K. L. A. Perera*).

THE *INSULARIS*-GROUP

The single species placed in this group is characterized by a lack of margination on the alitrunk, great development of occipital and propodeal spines and the extreme coarseness of the sulpturation, especially on the alitrunk.

Whilst the hairyness of the species and the form of sculpture suggest affinities with the *granulatus*-group some characters are present which are reminiscent of the *guineensis*-group of species from the Ethiopian region, namely the large size, strong occipital and propodeal spines and the pronounced tubercle on the alitrunk, in the same position as the spine of *guineensis*.

Cataulacus insularis F. Smith

(Text-fig. 29)

Cataulacus insularis F. Smith, 1857 : 80, pl. 2, figs 4, 4a. Holotype male, BORNEO: Sarawak (*A. R. Wallace*) (UM, Oxford,) [examined].

Cataulacus horridus F. Smith, 1857 : 81, pl. 2, fig. 3. Holotype worker, BORNEO: Sarawak (*A. R. Wallace*) (UM, Oxford) [examined]. **Syn. n.**

Worker. TL 4·8 – 7·0, HL 1·22 – 1·62, HW 1·38 – 1·80, CI 111 – 113, EL 0·46 – 0·56, OI 31 – 32, IOD 1·08 – 1·36, SL 0·76 – 1·00, SI 49 – 56, PW 1·00 – 1·36, AL 1·44 – 1·94, MTL 0·84 – 1·15 (10 measured).

Occipital crest absent; occipital corners prolonged into a pair of massive, subtriangular, broad, acute spines. Sides of head behind eyes denticulate, the denticles also present on the outer edges of the occipital spines and occasionally on the inner edges also. Alitrunk not marginate laterally, the dorsum rounding into the sides, but with a distinct, rather massive, broad tubercle on each side at the level of the promesonotal junction which may represent the last vestige of an ancestral margination. In profile the promesonotum forming a more or less continuous convexity and with a distinct step posteriorly at its junction with the propodeum; the dorsum of the latter on a lower level than that of the former. Propodeum with a pair of

very long spines, broad at the base and tapering to an acute apex. Mesokatepisternum developed into a large tuberculiform structure projecting laterally and visible in dorsal view. Gaster not marginate laterally.

Head reticulate-rugose, the interspaces reticulate-punctate. Dorsum of alitrunk very coarsely reticulate-foveolate with a fine reticulate-puncturation everywhere except the apical portions of the propodeal spines which are smooth and shiny. The sculpturation of the alitrunk is usually coarser and more rough-looking in larger individuals than in smaller. Gaster with a fine, dense rugoreticulum and reticulate-punctate interspaces, and usually also with a number of strong, longitudinal basigastric costulae.

All dorsal surfaces of head, alitrunk, gaster and appendages with numerous hairs.

Female. TL 6·8 – 7·5, HL 1·60 – 1·74, HW 1·80 – 2·00, CI 112 – 115, EL 0·52 – 0·60, OI 29 – 30, IOD 1·36 – 1·50, SL 1·02 – 1·08, SI 54 – 57, PW 1·60 – 1·70, AL 2·30 – 2·50, MTL 1·16 – 1·22 (3 measured).

As worker but the lateral tubercle of the alitrunk reduced to a low, broad swelling, less distinct than in the worker. A similar reduction is seen in the tubercle of the mesokatepisternum, whose apex is directed more anteriorly than in the above. Propodeal spines less well developed, very broad at the base, tapering rapidly to an acute apex. Sculpturation of head and pronotum as in worker, but the mesonotal sclerites and propodeal dorsum are longitudinally rugose; those on the propodeum diverging onto the basal parts of the spines.

Male. TL 6·4 – 6·6, HL 1·30 – 1·34, HW 1·42 – 1·58, CI 109 – 117, EL 0·48 – 0·50, OI 32 – 34, IOD 1·18 – 1·22, SL 0·88 – 0·90, SI 55 – 63, PW 1·30 – 1·32, AL 2·12 – 2·14, MTL 1·08 – 1·12 (2 measured).

Occipital spines proportionately as well developed as in worker, the sides of the head behind the eyes denticulate, as are the inner and outer borders of the occipital spines. Preocular tooth absent or reduced to a minute triangular prominence. Lateral tubercle of alitrunk not developed, but the tubercle of the mesokatepisternum distinct, directed forwards as in the female. Anterior arms of notauli distinct, the posterior arm reduced to a mere impression, not shining nor cross-ribbed like the anterior arms. Propodeal spines strongly developed, long and acute. Head reticulate-rugose with punctate interspaces, the rugae either longitudinal to the level of the posterior margin of the eyes and then becoming transverse, so that they form a broad arch around the ocelli, or irregularly distributed over the head.

One of the largest species of the Indo-Australian and Oriental regions and certainly one of the most easily recognizable, *insularis* is known from West Malaysia, Sumatra and Borneo. The great development of spines at the occipital corners and the lack of alitrunk margination immediately sets the species aside from its congeners. The species was described twice by F. Smith (1857) on consecutive pages of the same publication, once from a male and once from a worker. The synonymy was made by comparison of the two Smithian types with series from Borneo containing both castes, and it seems probable that both of Smith's species were described from a single series collected by Wallace.

Emery (1893*b* : 216) first noted the size variation of the species, mentioning a small worker from Perak, and Crawley & Jacobson (1924 : 401) described the female from Sibolga in Sumatra. In this description they mention that only the anterior ocellus was developed, whereas in all the females studied by the present author the lateral ocelli have also been present.

Material examined.

West Malaysia: Pahang, below the Gap, ca 850 m (*R. Crozier*); Perak (*Haviland*). Borneo: Kuching (*J. Hewitt*); N. Borneo, Tutu River (*E. Mjoberg*); N. Borneo,

Kaingaran River, Trus Madi Tr., 3900 ft (*P. W. Bryant*); N. Borneo, S. Tutu (*F. Mjoberg*); Sandakan (*Baker*); Sarawak, Mt. Poi (*E. Mjoberg*); W. Sarawak, Mt. Mating (*G. E. Bryant*); Sarawak (*Haviland*); Sarawak, Kapah River, tributary of R. Tinjar (*B. M. Hobby* and *A. W. Moore*). SUMATRA: Siantar, Pematang (*W. M. Mann*); Moeara Mahat (*W. M. Mann*).

THE FOSSIL SPECIES

Four species of *Cataulacus* are known only as fossils or from forms preserved in amber, these are:

anthracinus (Heer)	Radoboj Tertiary formations.
niger (Heer)	Radoboj Tertiary formations.
planiceps Emery	Sicilian Amber.
silvestrii Emery	Sicilian Amber.
resinosus Viehmeyer	Celebes Copal.

Apart from the last, which may not be a distinct species (see discussion below) these forms are from areas now well outside the range of the genus, in southern Europe. Although this revision is basically concerned with the living species of *Cataulacus* the following notes are added for completeness.

Cataulacus resinosus Viehmeyer **stat. n.**

Cataulacus taprobanae var. *resinosa* Viehmeyer, 1913 : 145. Syntype workers, SULAWESI: in copal.

This form was described from two specimens embedded in Celebes copal, originally deposited in the Zoological Museum, Dresden. Viehmeyer separated it from *taprobanae* on details of sculpturation and colouration, but in view of the fact that the range of *taprobanae* does not extend to Sulawesi and also that the copal is relatively recent it is probable that *resinosus* is not to be associated with that species at all. For this reason the variety has been given specific status provisionally, until a reassessment of the types can be made. At present the only living species known from Sulawesi is *flagitiosus*, and an examination of the *resinosus* types may show them to be synonymous with it.

Cataulacus silvestrii Emery

Cataulacus silvestrii Emery, 1891 : 147, pl. 1, figs 5–7. Holotype worker, SICILY: in Sicilian Amber (Museo. Mineral., Univ., Bologna).

In a number of ways *silvestrii* resembles *oberthueri* of Madagascar but in actuality is probably not directly related to that species. The single specimen known was very well described and figured by Emery, but some of the more salient features may be noted here.

CI approximately 100. The occipital corners are produced into a pair of long, acute and rather narrow spines, whilst running between them the occipital crest appears to be developed as

an acute angle. Sides of head behind eyes lack denticles and the preocular tooth is absent. The eyes are of average size, OI about 37, as approximated from Emery's fig. 7. Pronotum weakly if at all marginate, the margins without denticles. Propodeal spines well developed. Petiole and postpetiole very long and narrow, apparently much more so than in any living species of the genus. Sculpturation everywhere is basically a rugoreticulum and the dorsal surfaces of the head and body possess short, erect hairs. TL was given by Emery as 5·0.

Cataulacus planiceps Emery

Cataulacus planiceps Emery, 1891 : 148, pl. 1, figs 8, 9. Syntype workers, SICILY: in Sicilian Amber (Museo. Mineral., Univ., Bologna).

This second species from the Sicilian amber is much more similar to the common smaller African species of the present day than is *silvestrii*. Its affinities appear to lie with *pygmaeus* and its allies but without a review of the types this is of course mere conjecture.

TL given as 4·2. Occipital corners armed with a single spine; the occipital crest apparently developed as an acute angle and perhaps with a few denticles upon it laterally (these are shown in Emery's fig. 8 but not in fig. 9). Sides of head behind eyes crenulate; preocular tooth apparently absent. Alitrunk marginate, denticulate upon the margins. Propodeal spines short but acute. Segments of pedicel massive. Head and alitrunk reticulate-rugose with reticulate-punctate interspaces. Short hairs numerous on all dorsal surfaces.

Although I have only Emery's original descriptions and figures to work from the idea has occurred to me that the two specimens represented by the name *planiceps* may in fact be two closely related but separate species. It seems to me that the two figures, 8 and 9 of Emery, are each of one of the available specimens, and some interesting differences are noticeable between the two. For instance, although the two figures are drawn to the same scale (25 to 1) the head in fig. 8 is much longer than in fig. 9, even after allowance has been made for the difference in total length between the two (i.e. 0·2 mm) and the different angle at which they are drawn. The occipital spines of fig. 8 are smaller than those of fig. 9 and the spine visible in the former is flanked upon the occipital margin by a row of denticles, which are absent from the latter. In fig. 9 a large triangular plate or prominence projects from below the anterior third of the length of the eye and the posterior portion of the frontal carinae; this is not indicated at all in fig. 8.

Although these differences seem minor and may be due to omissions on Emery's part they are characters which have proved to be relatively consistent in other parts of the genus. A re-examination of the types would probably quickly prove or disprove the above comments.

Cataulacus anthracinus (Heer)

Attopsis anthracina Heer, 1850 : 156, pl. 12, fig. 12. Holotype male, YUGOSLAVIA: Radoboj, Tertiary formations.

Cataulacus anthracina (Heer) Mayr, 1867 : 58 [in text].

Attopsis nigra Heer, 1850 : 157, pl. 12, fig. 13. Holotype female, YUGOSLAVIA: Radoboj, Tertiary formations. Synonymy by Mayr, 1867 : 58 [in text].

Some of the ants described by Heer (1850; 1867) from Öhningen and Radoboj Tertiary formations were reviewed by Mayr (1867). In this publication Mayr pointed out that *nigra* was to be identified as a *Cataulacus* species and that he identified *anthracina* with the former species. Although no formal statement of synonymy was made this appears to have been the intention and was recorded as such in the catalogue of Dalla Torre (1893 : 137). All the specimens discussed were more or less fragmentary, and as Heer used a number of form-genera containing numerous unrelated forms a review of his material is to be desired.

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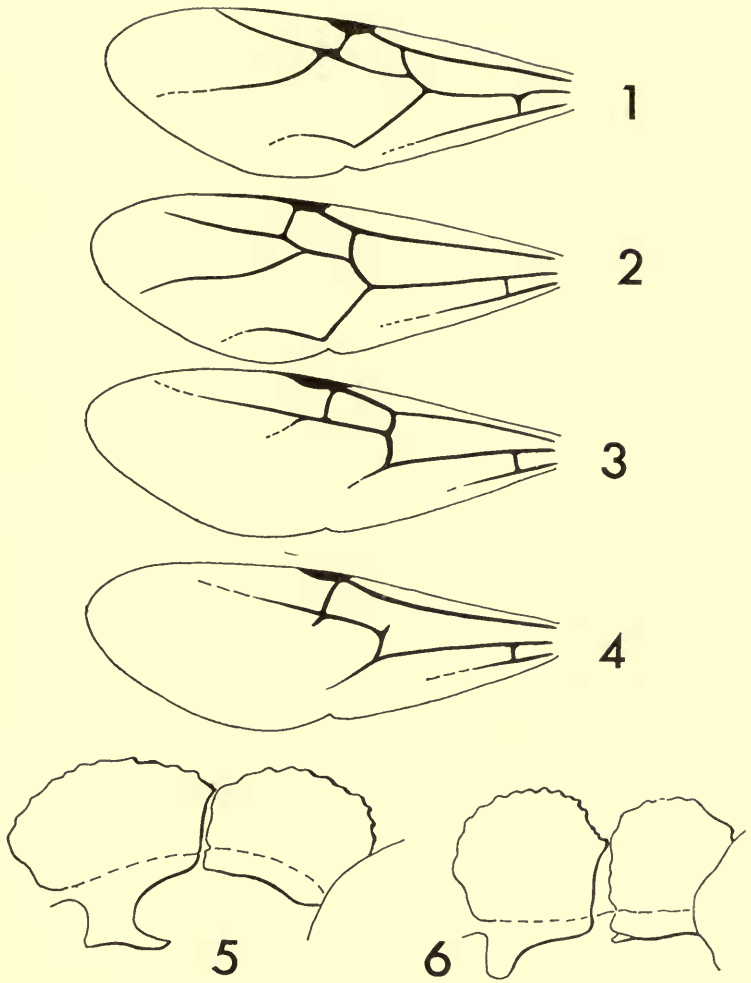
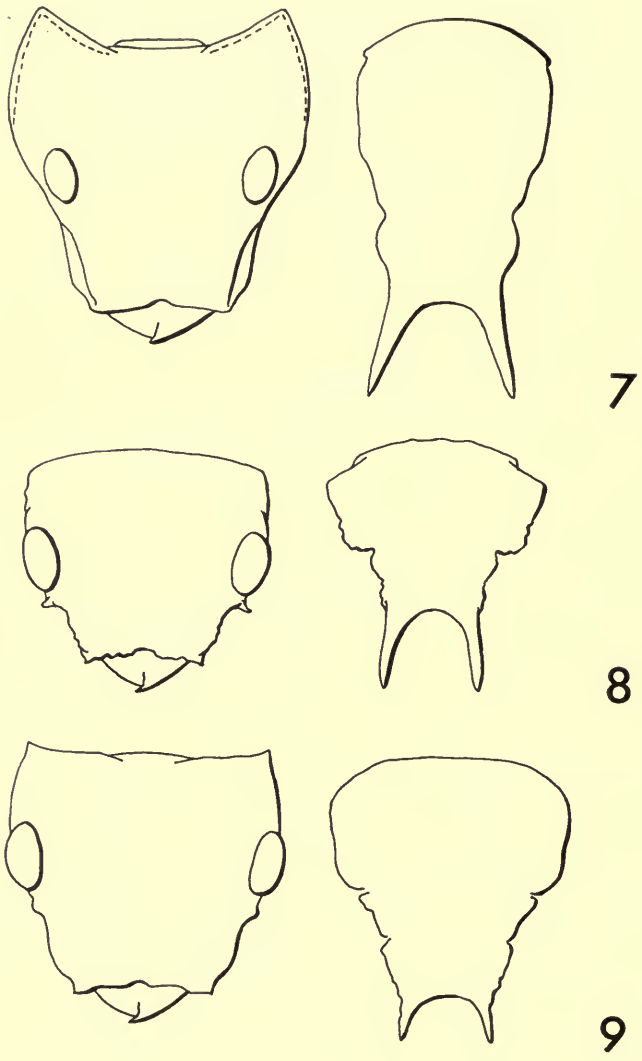
—— 1925. Zoological results of the Swedish Expedition to Central Africa, 1921. Insecta 10, Formicidae. *Ark. Zool.* **17**(A) : 1–3.

WROUGHTON, R. C. 1892. Our ants. Part 2. *J. Bombay nat. Hist. Soc.* **7** : 175–202, 2 pls.



FIGS 1–4. Forewings of female to illustrate venation. 1. *egenus*; 2. *latus*; 3. *brevisetosus*; 4. *catuvolcus*.

FIGS 5, 6. Profile of pedicel in workers to illustrate development of subpetiolar process. 5. *hispidulus*; 6. *granulatus*.



FIGS 7–9. Outline of head and dorsal alitrunk of 7. *oberthueri*; 8. *kohli*; 9. *lobatus* workers. Pilosity, etc., omitted.

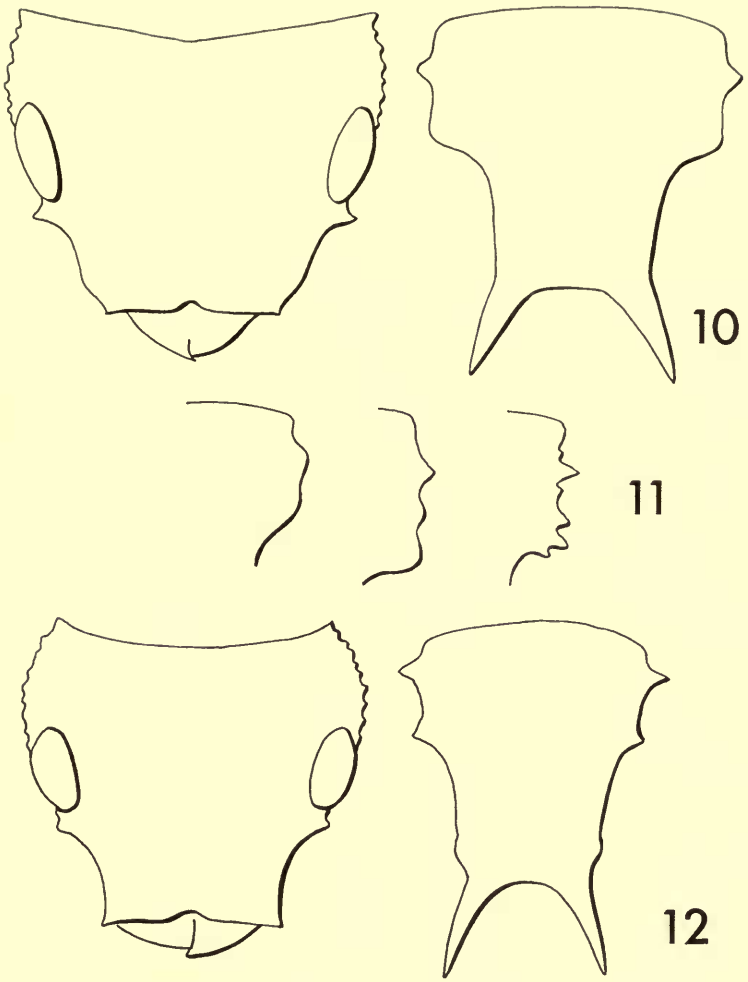
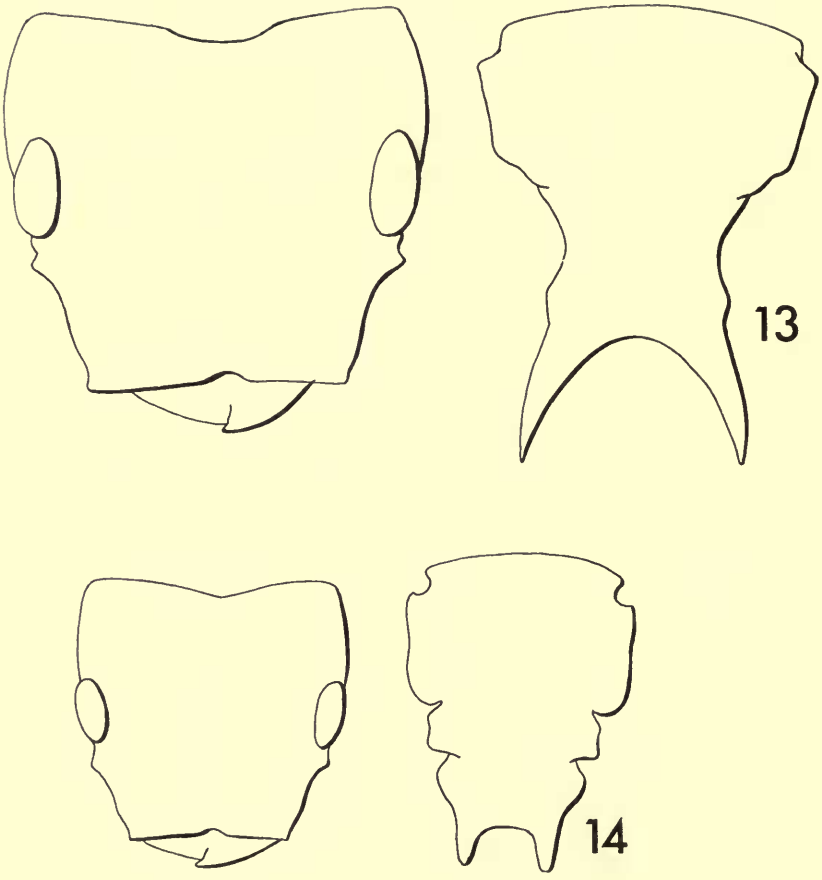


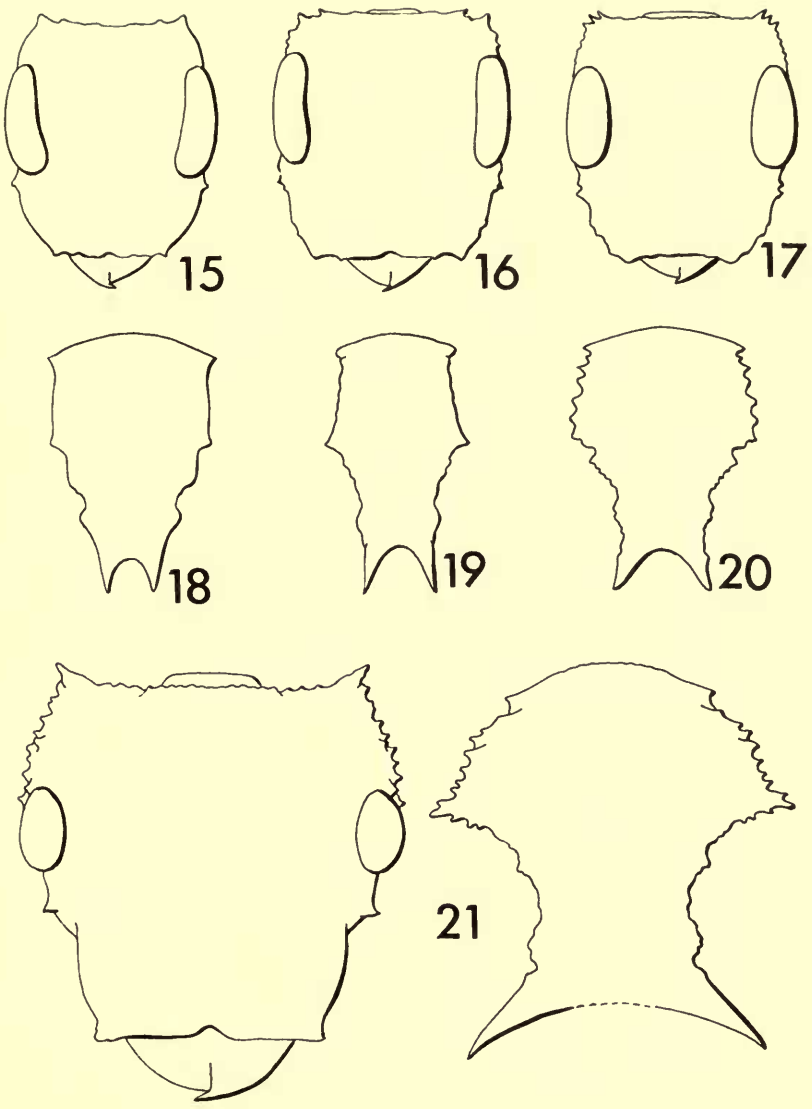
FIG. 10. Outline of head and dorsal alitrunk of *huberi* worker.

FIG. 11. Outline of pronotal margin of *huberi* worker to show variation in development of teeth.

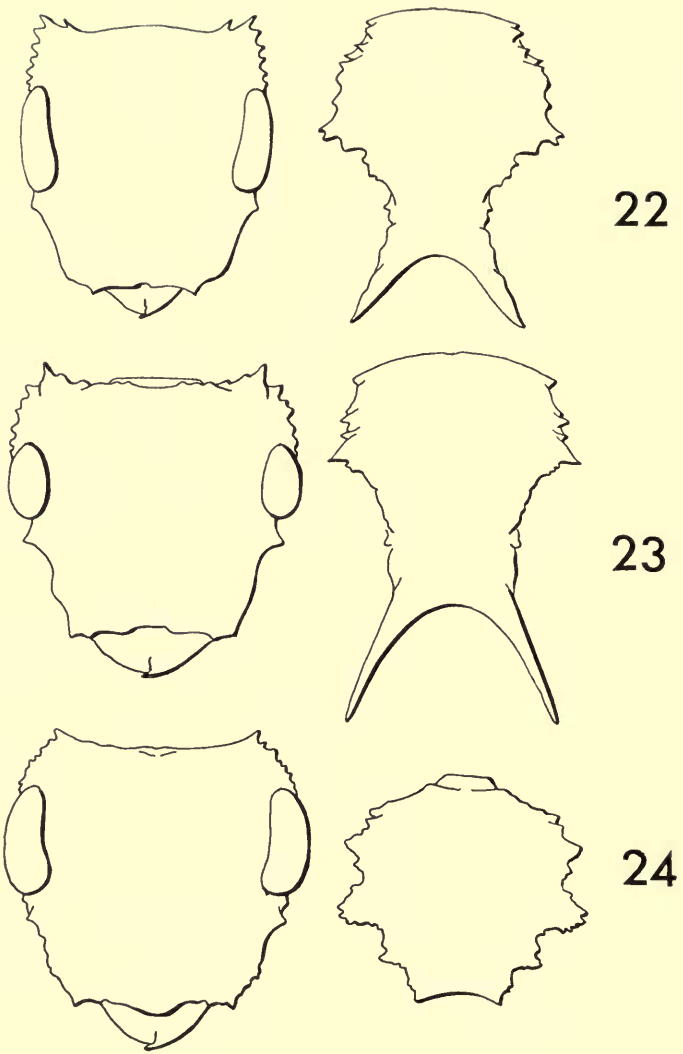
FIG. 12. Outline of head and dorsal alitrunk of *pullus* worker.



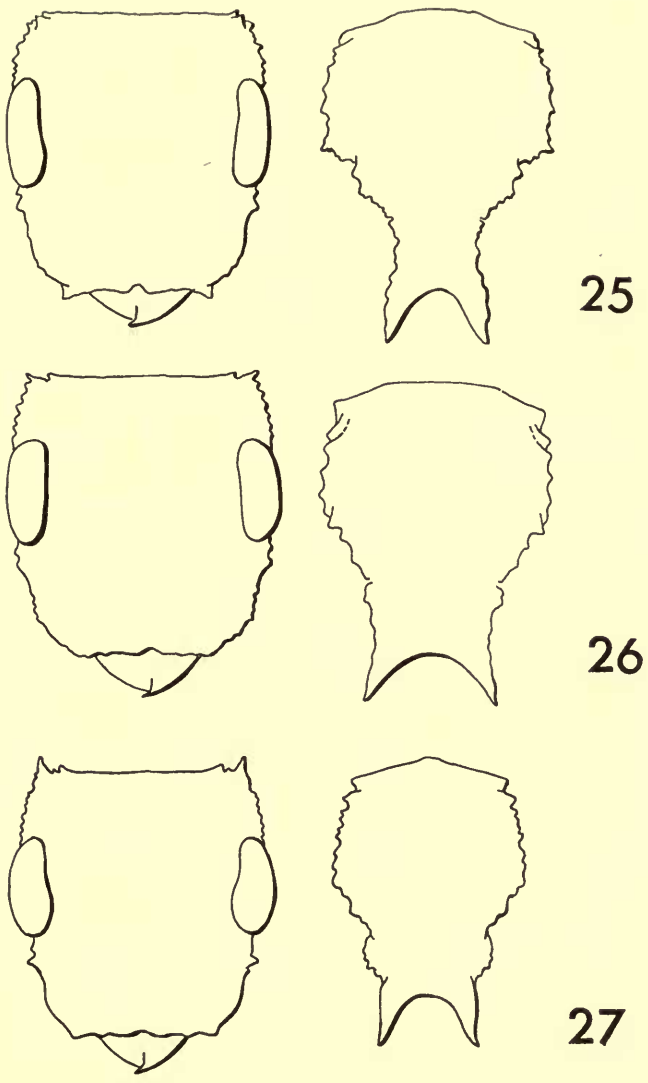
FIGS 13, 14. Outline of head and dorsal alitrunk of 13. *tardus* (large worker); 14. *regularis*.



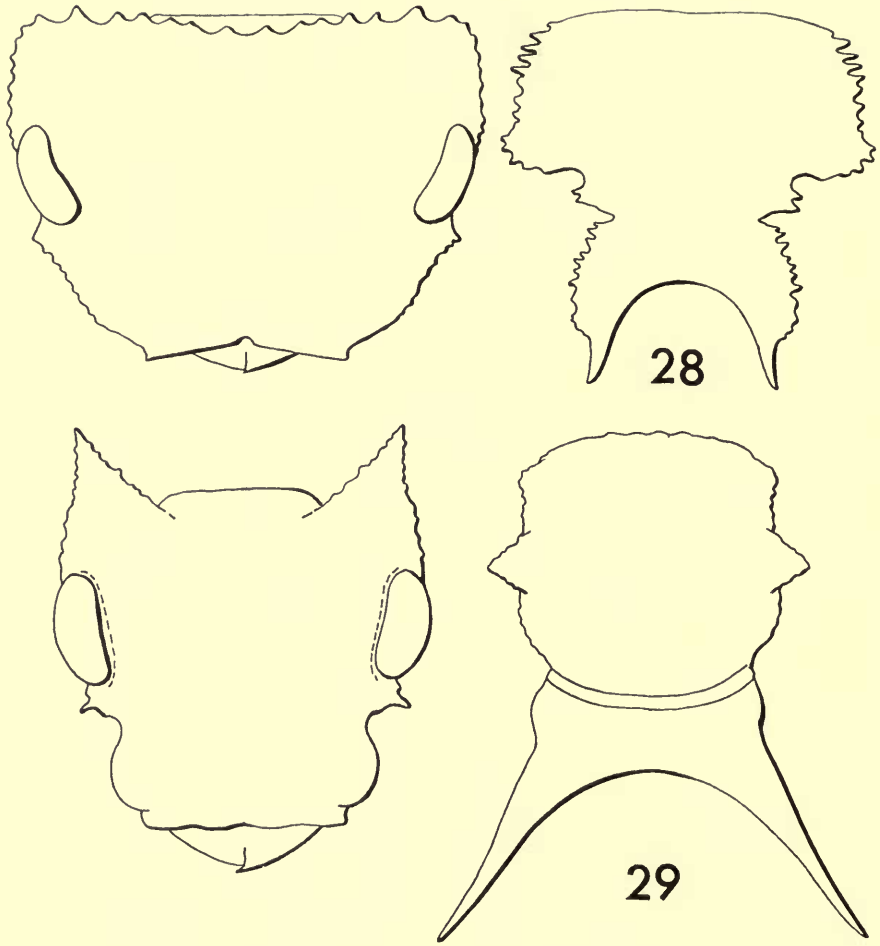
FIGS 15–21. Outline of head and dorsal alitrunk of 15, 18. *adpressus* sp. n., holotype worker; 16, 19. *vorticus* sp. n. holotype worker; 17, 20. *brevisetosus*; 21. *erinaceus*.



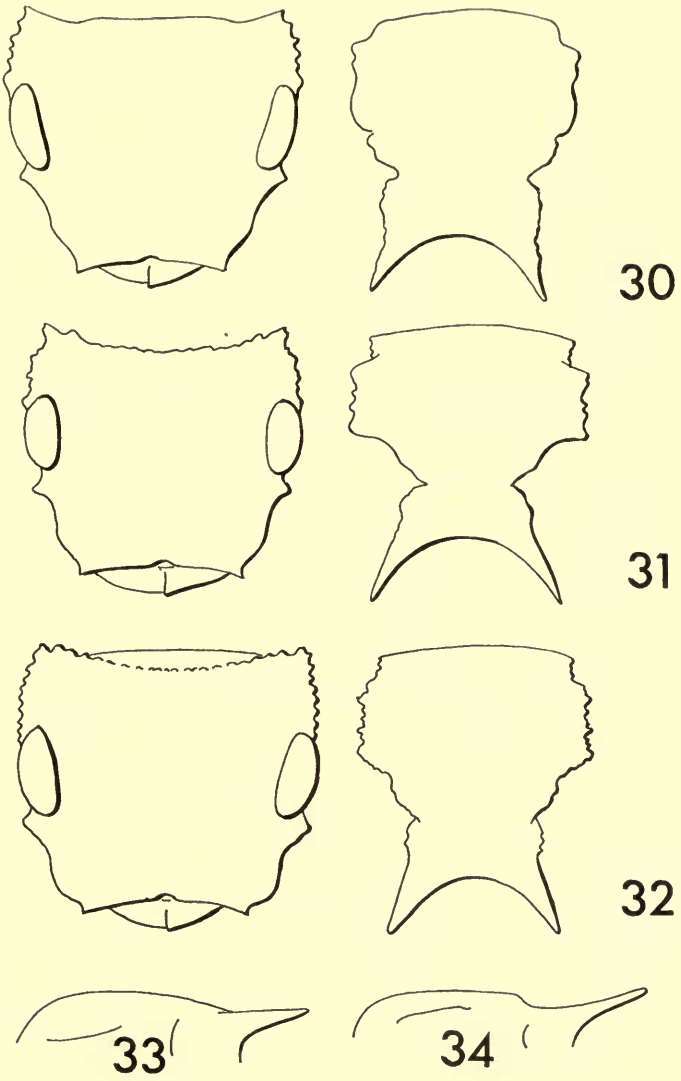
FIGS 22–24. Outline of head and dorsal alitrunk of 22. *greggi* sp. n., paratype worker; 23. *guineensis*; 24. *mocquerysi*.



FIGS 25–27. Outline of head and dorsal alitrunk of 25. *pygmaeus;* 26. *intrudens* (small worker); 27. *wissmanni*.

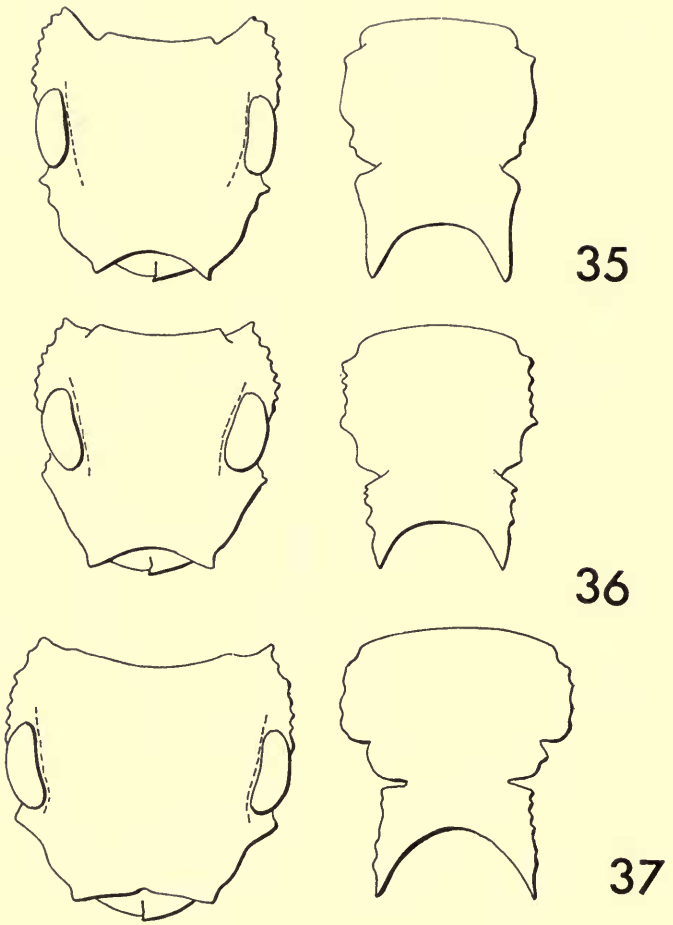


FIGS 28, 29. Outline of head and dorsal alitrunk of 28. *latissimus*; 29. *insularis*.

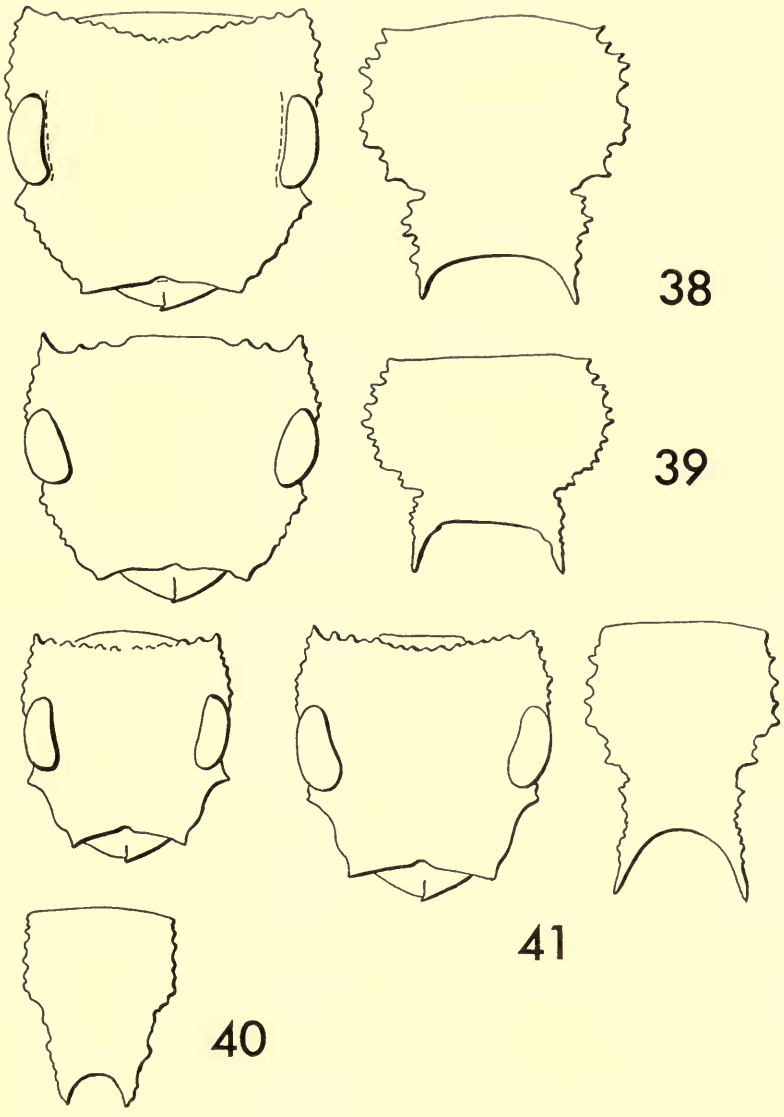


FIGS 30–32. Outline of head and dorsal alitrunk of 30. *chapmani* sp. n. holotype worker; 31. *flagitiosus*; 32. *taprobanae*.

FIGS 33, 34. Profile of alitrunk to show dorsal outline in workers of 33. *taprobanae*; 34. *flagitiosus*.



FIGS 35–37. Outline of head and dorsal alitrunk of 35. *reticulatus*; 36. *praetextus*; 37. *catuvolcus* sp. n., holotype worker.



FIGS 38–41. Outline of head and dorsal alitrunk of 38. *marginatus* sp. n., holotype worker; 39. *hispidulus*; 40. *simoni*; 41. *nenassus* sp. n.; holotype worker.

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Specific and infraspecific names are listed below in alphabetical order without regard to their rank. Junior synonyms and unavailable names are in *italics*.

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